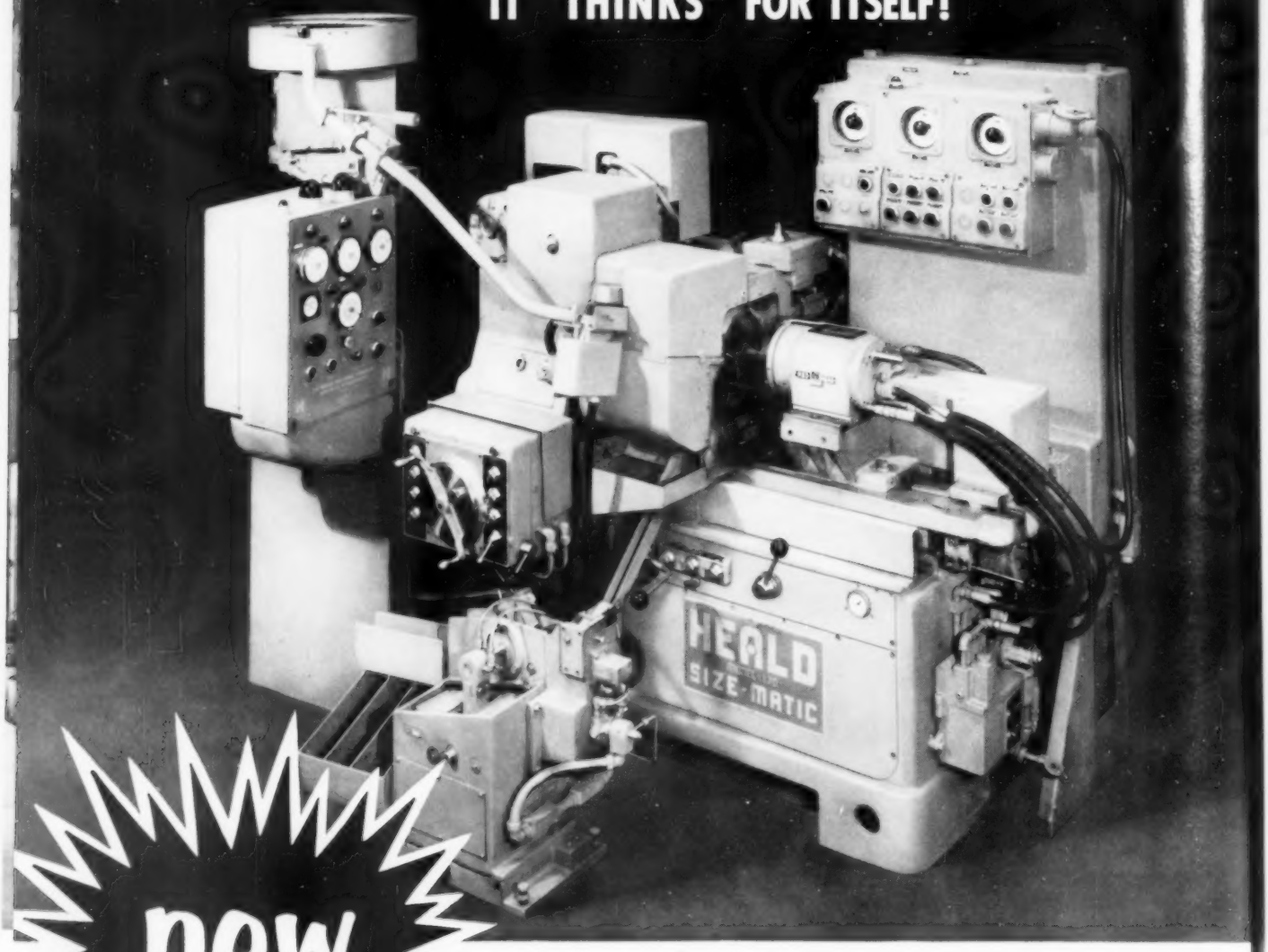
the TOOL ENGINEER

DECEMBER 1955

PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS

IT "THINKS" FOR ITSELF!



new

HEALD MODEL 170 AUTOMATIC CHUCKER

with after-gaging and **FEEDBACK**
holds close size limits automatically

WHAT FEEDBACK MEANS TO YOU

The practical application of feedback to internal grinding and borizing equipment opens a new field for cutting production costs on long-run jobs.

A signal from the after-gaging unit is fed back to the tooling or diamond — automatically correcting any tendency to drift out of size. Feedback limits are well within specified tolerances of the work, thus making any needed corrections *before* parts reach scrap limits.

All this is done without any effort or attention on the part of the operator. That means higher productivity per man-hour — one operator can easily control a greater number of machines. It means that off-size scrap parts are virtually eliminated. It means higher sustained production, with greater accuracy and precision, at *lower cost per part.*

The new, completely automated Heald Model 170 Auto Chucking Size-Matic shown above makes short work of grinding a blind interrupted bore in valve tappet bodies.

With *automatic* hopper feed, orientation, chucking, cycling and unloading, a net production of 204 pieces per hour at 90% efficiency is consistently maintained. And with after-gaging and feedback, tolerances of .0003 on bore size, .00005 maximum out-of-roundness and .0001 maximum taper are easily held. Feedback enables the machine to detect tendencies toward errors—and correct them automatically, without operator attention.

This is Heald automation at work—bringing you higher production and greater precision than ever before. For the newest advances in internal grinding, rotary surface grinding and borizing — It Pays To Come To Heald.

For information on the new 170 Size-Matic, send for Bulletin 2-170-T.

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Subsidiary of The Cincinnati Milling Machine Co.
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HEALD ®

Cover: Sensitive tracer-control system follows a pen-and-ink line drawing to accurately mill a complicated cam. Principles of this spark-gap tracer are discussed in the article beginning on page 82.

The Tool Engineer

Volume XXXV, No. 6 December 1955

TECHNICAL ARTICLES

We Got What It Takes! . . . . . By Harry B. Osborn, Jr. 73
Machine Development Program Conserves Production Time By V. M. Colton 75
Gadgets 78
Cam Machining without a Master Former . . . . . By Frank W. Hale 82
Grinding High-Speed Steels . . . . . By N. P. Robie and A. D. Stover 88
Tool Engineering Solves Installation Problem . . . . . By R. E. Meyers 91
Designed for Production 98
How To Apply Carbide Tooling to Automatics . . . . . By E. J. Weller 103
Tools at Work 110
Controlling Climate Effects . . . . . By L. E. Doyle and Ronald D. Lemon 113
Higher Cutting Speeds with Cemented Oxides 121
Surface Roughness, Waviness and Lay (Reference Sheet) 123

ASTE NEWS

Featured This Month (Index) 128
Directors Meet in Detroit 129
"Tooling for Tomorrow" to Keynote Exposition 132
Wentworth Institute Chapter . . . . . By Melvin P. Burns 134
Open Another Door to Opportunity! . . . . . By H. Verne Loeppert 135
Baltimore Members Say 'Merry Christmas' 136
Education Awards Announced for 1956 138
Coming Meetings 148

DEPARTMENTS

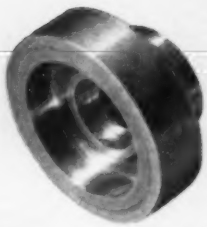
Abstracts of Foreign Literature 185
Field Notes 181
Good Reading 194
Letter from the Editor 3
Men at Work 189
Progress in Production 151
Technical Digests 197
Technical Shorts 191
Tools of Today 155
Trade Literature 177
Who's Meeting—and Where 193
Advertisers' Index 278

Annual Editorial Index (Vols. XXXIV, XXXV) . . . 269
Index of 1955 Advertisers 275

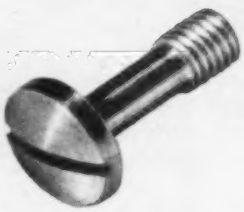
PLANNING · ENGINEERING · CONTROL · TOOLING · EQUIPMENT · PRODUCTION

THE TOOL ENGINEER is regularly indexed in the Engineering Index Service and the Industrial Arts Index

HERE'S PROOF OF VERSATILITY



NITRALLOY-G STEEL



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New cutting oil, Sunicut 5534, is moderately priced... gives excellent machining results on wide range of steels

New Sunicut 5534 is a non-emulsifying, transparent cutting oil specially compounded to give above-average machining results to operators who want a single oil to machine a large variety of ferrous metals.

Tests have proved that new Sunicut 5534 meets this demand for an all-purpose cutting oil. It is ideal for general screw machine and turret lathe work. It is also excellent for tapping, drilling, threading, and light stamping operations. In addition, new Sunicut 5534 can be used on many special machining jobs, both high and low speed, with metals ranging from B1112 to 4130 as well as free-machining stainless steels.

For complete information about new Sunicut 5534 and how it can help you reduce your oil inventories...lower your production costs...see your Sun representative. Or write SUN OIL COMPANY, Phila. 3, Pa., Dept. TE-12.

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The Tool Engineer

Tools for Tomorrow

Not a metallurgist, not a ceramist, but a chemist was responsible for developing the cemented-oxide tool material announced by Carboloy. This type of material is commonly called "ceramic" and is being developed and perfected as tools by many manufacturers. Tests conducted at the Rodman Laboratory of Watertown Arsenal, Warner & Swasey Co. and other laboratories have shown it to be the most promising development in cutting tools since the introduction of carbides.

Development of this material by a chemist accentuates the dependence of engineers on each other and on the basic sciences. Approaches to problems by experts in other fields introduce fresh creative thinking. A more generally recognized example of the same type of achievement was the original work on the atom bomb. It was developed almost entirely by physicists. Everyone appreciates the vast possibilities, new industries and benefits to mankind that can be developed from the intelligent application of nuclear fission.

Principally composed of aluminum oxide and bonding materials, ceramic tools have remarkable cutting properties in spite of their inherent brittleness. It remains only for the tool engineer to apply them intelligently to his machining problems. He must plan to utilize their desirable characteristics while minimizing their limitations with the knowledge that future improvements will provide even better cutting tools.

Only recently have machine tools been developed to the point of having sufficient capacity and rigidity to utilize all the advantages of carbides. Now, ceramic tools may double or even triple the demands on machine capacity. Progress was ever thus, one development necessitating improvements in other elements of production. The incentives for improvement have encouraged the chain reactions necessary for making more goods of better quality at lower cost—the goal of every tool engineer.

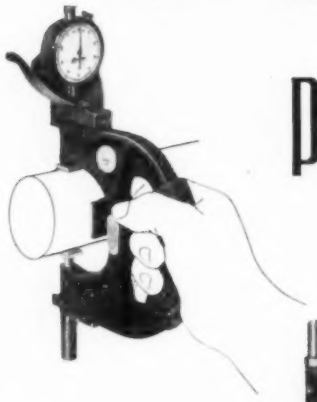
John W Greve
EDITOR

No line of Dial Snap Gages offers so much!

Paralloc SERIES

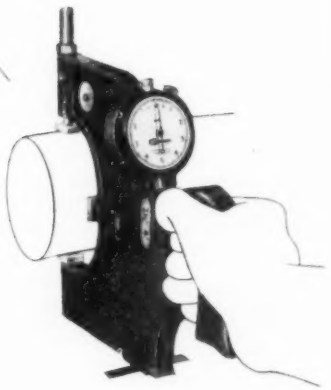
Paralloc Dial Snap Gages, available in types "D" and "L", feature *large square anvils* (tungsten carbide faced) which are *flat and parallel*. The D-TYPE, available in eight sizes up to 8 inches, is a truly modern general purpose design, embodying many unusual features including an adjustable plunger tension. The L-TYPE, available in sizes up to 14 inches, which has a 100% shockproof movement actuated by the lower anvil, is designed for the toughest of long run jobs.

Light in weight, rugged in construction, Paralloc Dial Snap Gages are designed to withstand severe usage. The Paralloc pin locking mechanism preserves the parallelism of the anvil faces throughout the adjustment range to an exceptional degree of accuracy.



Paralloc®
D-TYPE

Paralloc®
L-TYPE



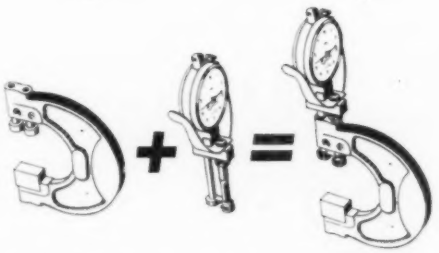
NEW! Dializer SF SERIES

Here is a new line of lightweight, long range Dial Snap Gages which feature *low cost* precision. Nine sizes up to 13½ inches. Upper anvil is spherical, lower anvil is flat; both anvils are faced with tungsten carbide. Settings are easily accomplished with a fine adjustment screw. Other features include provision for rotating the indicator and an adjustable contact pressure. Wide choice of indicator sizes and graduations.

SF-TYPE

Dializers®

Here is the ultimate in *economy: Any make* of Adjustable Limit Snap Gage conforming to American Gage Design specifications becomes a *modern dial snap gage* when equipped with STANDARD's *Dializer*.



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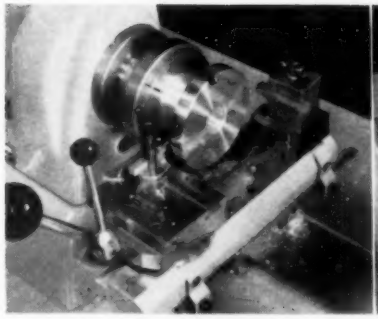
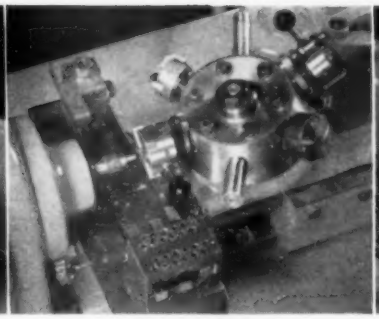
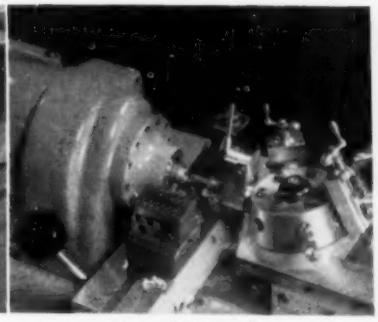
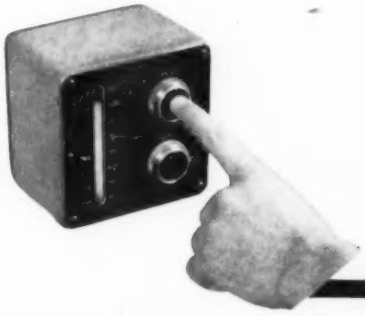
NEW Variable Speed Machine
for
PRODUCTION DEPARTMENTS


Large Work


Threading


Small Work



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Produce More Precision Parts at Lower Cost with this NEW Second Operation Machine

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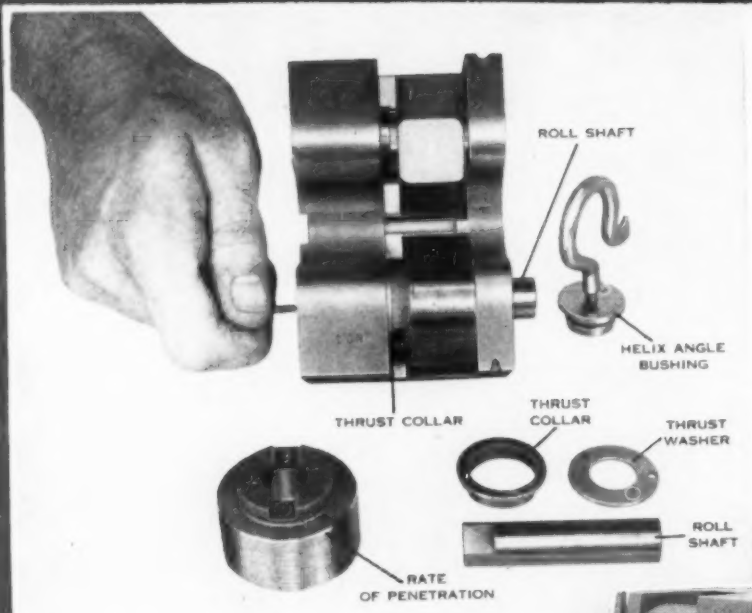
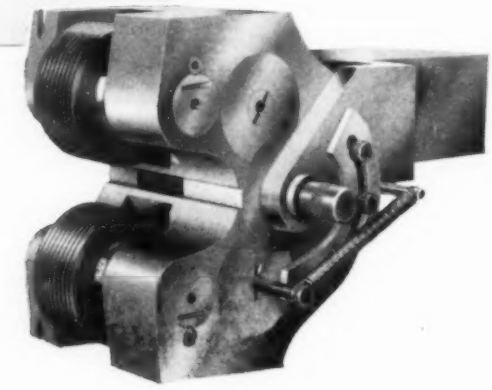


The helix angle bushings, thrust collars, and thrust washers provide a corrective between the workpiece and roll helixes, eliminating drunkenness and ensuring coarse pitch threads to Class 4 fit. All helix angle equipment is designed and marked for rapid changes. This arrangement together with design features allowing infinite size adjustment without loss of rigidity assures rolling all threads as though the attachment were exclusively engineered for that particular work.



Coarse Pitch Threads Rolled to Class 4 Fit..

The LANROLL Thread Rolling Attachments offer features designed to ensure greater accuracy, flexibility and economy when producing threads . . .

1. *PERFECT HELIX AGREEMENT* allows rolling coarse pitch threads to Class 4 tolerances with long roll life. Threads can also be rolled directly to a shoulder with safety.
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4. *RAPID AND PRECISE SET-UPS* are possible with special gaging methods designed for easy use and the elimination of "cut-and-try" set-ups.
5. Five sizes of Attachments roll a wide range of threads:
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Other outstanding advantages of these LANROLL Attachments include: large diameter rolls for longer roll life; taper correction; and excellent thread finish and microstructure. For additional information ask for Bulletin G-96—please send specifications when writing.

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424

you can speed up production with this

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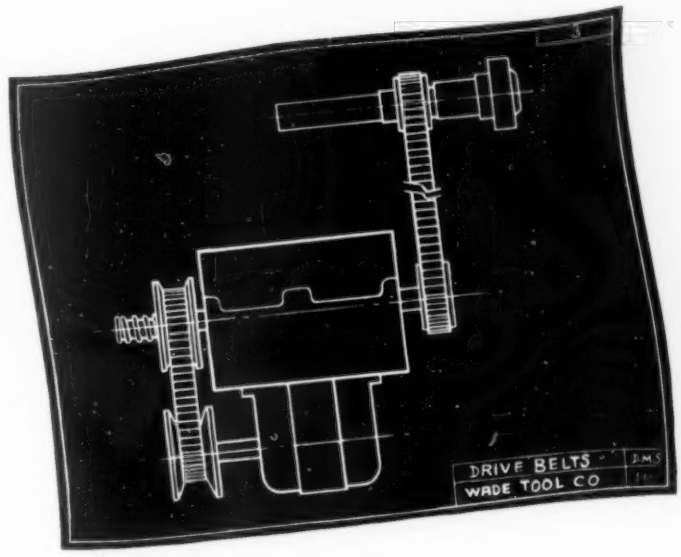
The combination of two belts, as illustrated, with clutches gives a high-low speed change and a fast reverse, insuring *maximum production from this type machine.*



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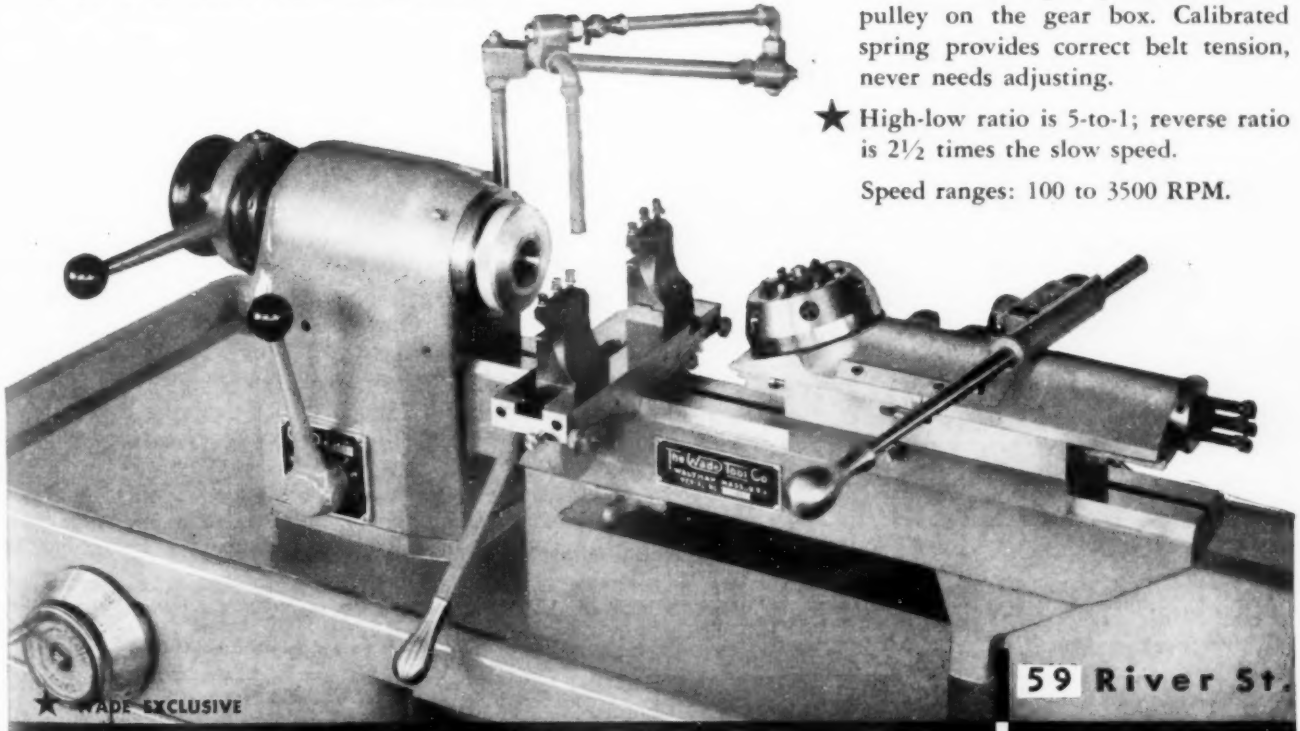
no. 73 HAND TURRET LATHE

★ Spindle driven by Gilmer steel-cabled timing belt. (Positive drive, cog-tooth design — no belt tension required.)

Variable speed pitch pulley belt connects the motor pulley and the driven pulley on the gear box. Calibrated spring provides correct belt tension, never needs adjusting.

★ High-low ratio is 5-to-1; reverse ratio is 2½ times the slow speed.

Speed ranges: 100 to 3500 RPM.



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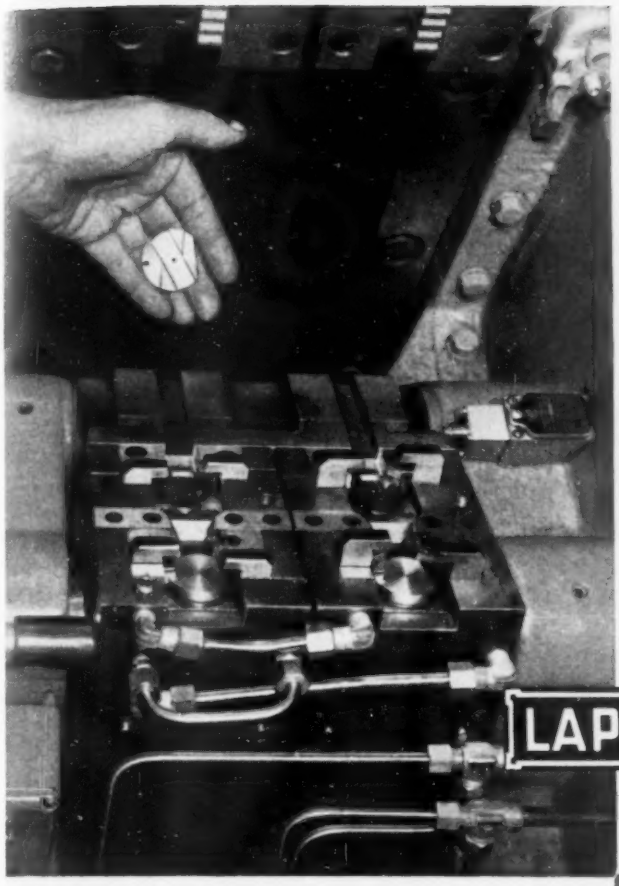


BROACHING'S BEST for SMALL PARTS, too!

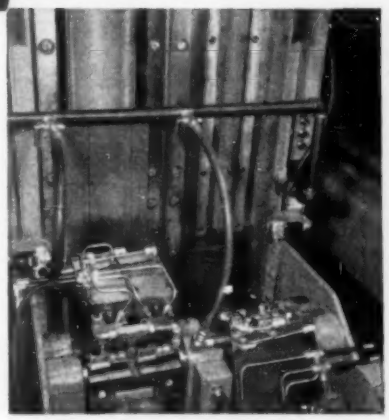
. . . for example, these CAMERA PARTS are typical of the smaller items that are being surface-broached every day on double ram and single ram type **vertical**

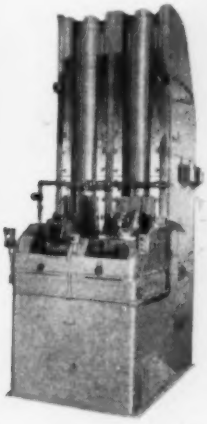
LAPOINTE BROACHING MACHINES

The slot and flat on the camera part, above, are simultaneously broached on this small, rugged LAPOINTE DRV Broaching Machine. A double work nest, provided with hydraulic clamping mechanism, accepts two stacked parts at each of two stations.

Production: 4 parts per stroke, 500 finish-broached parts per hour at 80% efficiency!

Tell us what you are making — perhaps we can help you!





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LAPOINTE BROACHING of small parts gives you

- greater production,
- better finish on machined surfaces.

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THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

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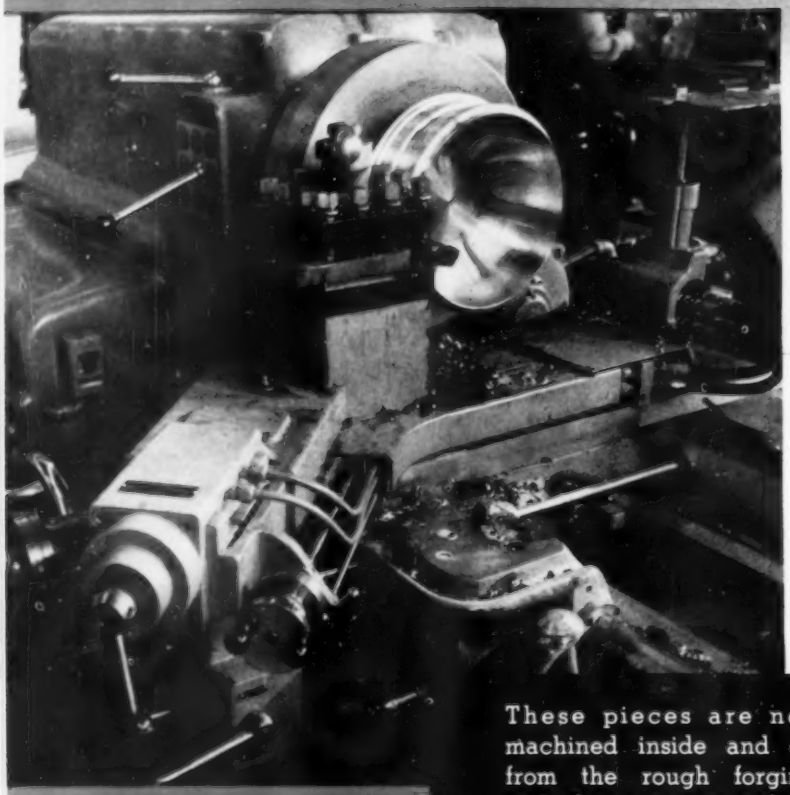
and increases production *three hundred per cent*

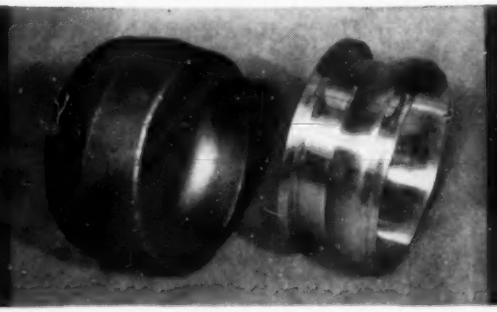


Machining the various contours of these guided missile components with the accuracy and finish required was a problem that Rheem Mfg. Co., Aircraft Division at Downey, California, had to lick.

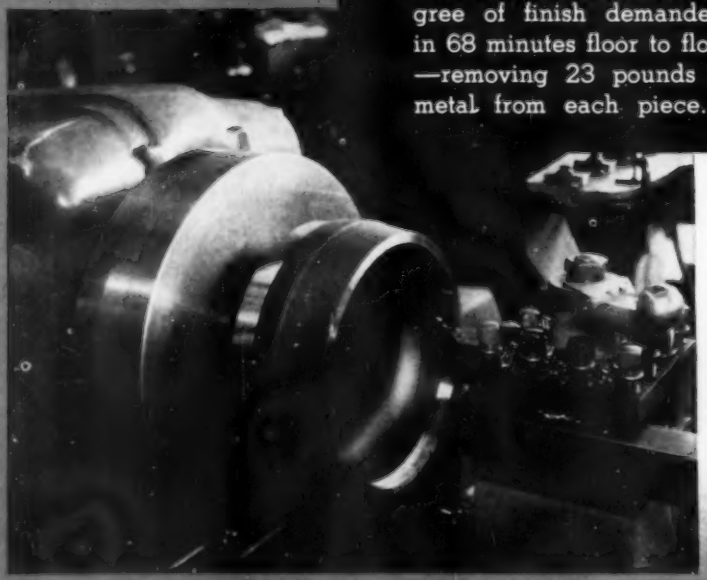
The answer . . .

"AMERICAN"

HYDRAULIC DUPLICATING LATHES



These pieces are now machined inside and out from the rough forging, with the accuracy and degree of finish demanded, in 68 minutes floor to floor —removing 23 pounds of metal from each piece.



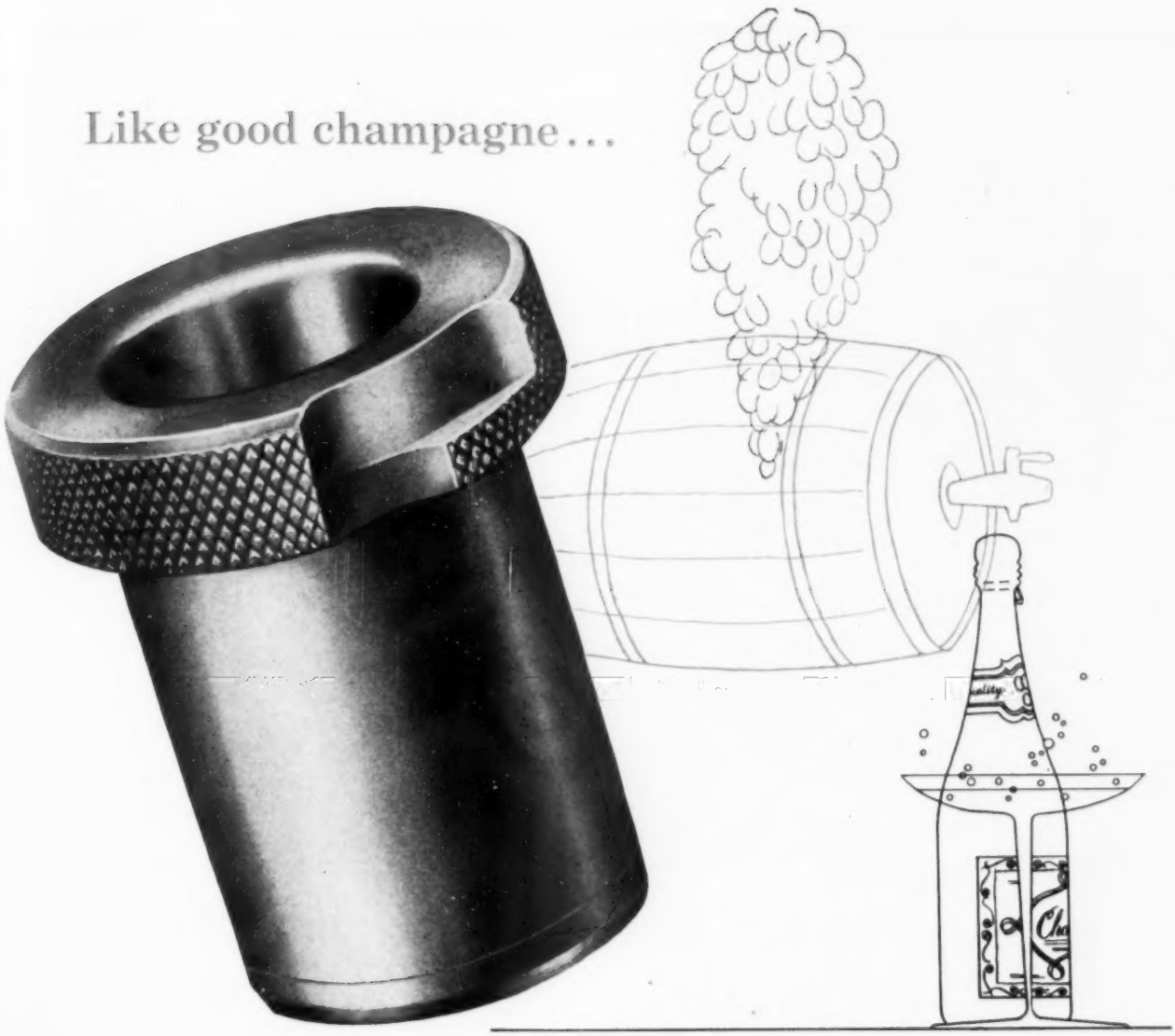
The simplicity and dependability of the duplicating equipment plus the power and sturdiness of the "AMERICAN" Lathe proved just the right combination for this difficult job.

We specialize in "tough ones" —better ask us about your "problem" jobs.

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

Like good champagne...



American ***drill bushings are meticulously made***

To assure you of the finest precision drill jig bushings, American uses the best materials obtainable, highly skilled personnel, and the most modern equipment. Each drill bushing produced must meet rigid requirements for accuracy by the latest testing devices. Then through American's outstanding distribution methods, the finest drill bushings are made immediately available in your locality.

For precision, longer wearing drill bushings with extra features as standard equipment—demand American.

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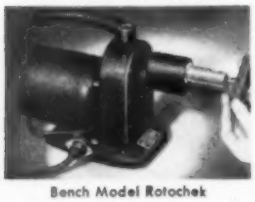
Taft-Peirce Rotochek Gages Threads 3 Times Faster

Flexible Shaft Model Rotochek

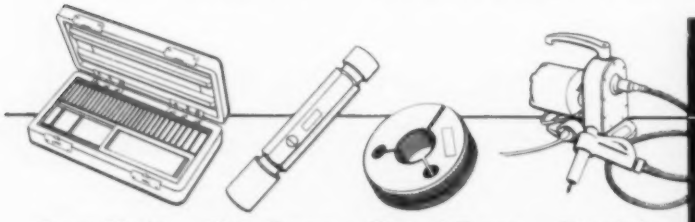


Bench Model Rotochek

You can triple your thread inspection rate with this simple, inexpensive device. A Rotochek is fast . . . accurate . . . easy to use. Operators report from 3 to 4 times as many parts inspected daily.

Simply push-pull and the part is inspected. Bring the part to the Rotochek, or the Rotochek to the part — a slight push and gage screws into the work. Release the pressure and the gage stops. Pull — and it disengages.

Available in bench model, or with gaging head on flexible shaft. Adaptors permit use of reversible thread members and ring gages. Send for bulletin with full description and prices.



Gage Blocks Plain Gages Thread Gages Rotochek

T-P means Top Precision

T P

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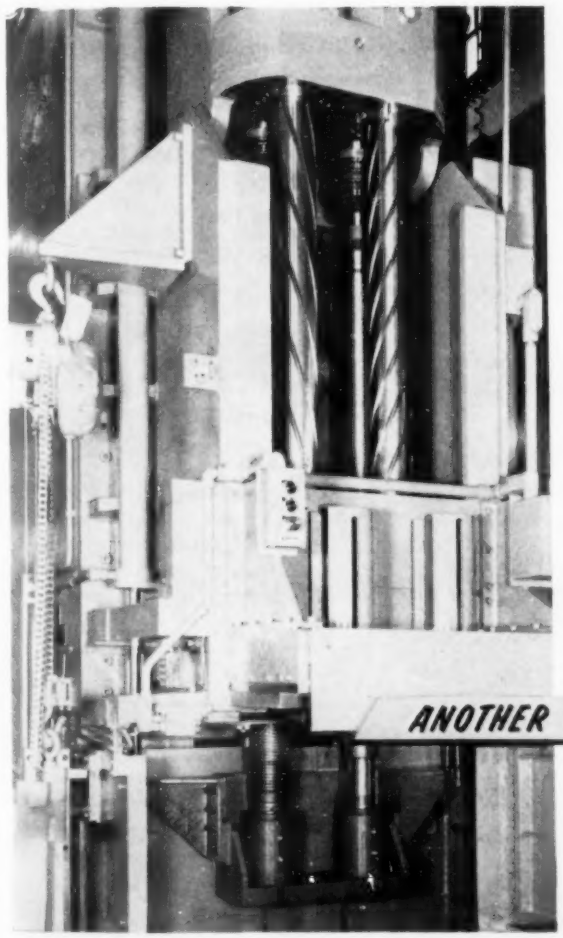
QUALITY GEARS for QUIET TRANSMISSIONS



...broached automatically

Producing quality internal helical gear teeth is the task of two Colonial 2-station RUF-50-72 pull-up broaching machines. All gears are automatically loaded from cartridges and automatically unloaded, with the larger diameter gears being broached two at a time on each station. These quiet transmission gears with three different leads and diameters, have two left hand and one right hand spiral. All three different gears may be broached as production demands on either of the two stations.

Broaches are guided on both ends through full length of cut; broach handling is automatic with safety interlock. Colonial broaches for these gears weigh as much as 800 pounds, and are 81 inches long. Broaches return through a retractable brush and a pressure spray washes chips away. An electric hoist mounted on a universal loading arm handles these broaches in and out of the machine. A cooler for cutting oil, a magnetic chip separator, and an automatic chip conveyor are also furnished on these two Colonial pull-ups.

ANOTHER EXAMPLE OF COLONIAL UNIFIED BROACHING

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DETROIT 13, MICH.

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men can

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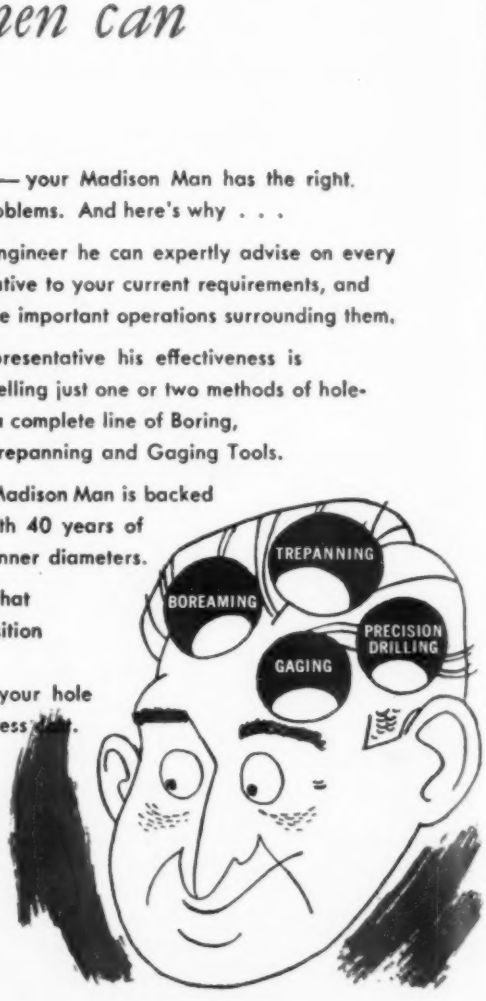
As a Madison Sales Engineer he can expertly advise on every phase of hole-making relative to your current requirements, and with an understanding of the important operations surrounding them.

As a Madison Sales Representative his effectiveness is not channeled by selling just one or two methods of hole-making. He alone handles a complete line of Boring, Precision Drilling, Trepanning and Gaging Tools.

As a person to rely upon, your Madison Man is backed by a parent company with 40 years of specialized experience in producing inner diameters.

Therefore, it makes good sense that your Madison Man is in the strong position of being able to recommend to you on an honest and intelligent basis the correct tooling for your hole application that will do the job better, faster and at less cost.



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"inner diameters are our business"

Production Pointers from GISHOLT

MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

Highlighting the great, new Gisholt MASTERLINE Machines—emphasizing new strides in efficiency and in lowering unit costs on a variety of jobs.

SPEEDS UP WORM SHAFT OUTPUT

New Gisholt No. 12 Automatic with JETracer turns trick

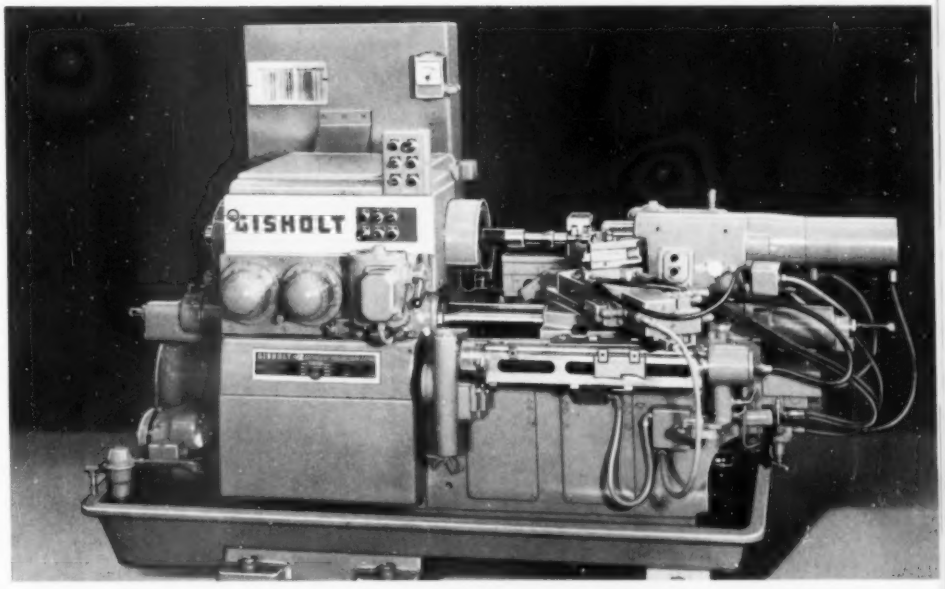
Here's how to boost production and cut costs on steel traverse worm shafts, using the new Gisholt MASTERLINE No. 12 Automatic Production Lathe.

Special equipment includes a Gisholt JETracer Slide mounted on the front carriage, plus a new triangular shaped tool post—hydraulically operated and automatically indexed—carrying a roughing and finishing tool. This arrangement permits maximum tool clearance with a minimum of overhang. Machining is fast, with a spindle speed of 900 RPM and a 40 HP motor providing power for the heavy roughing cuts.

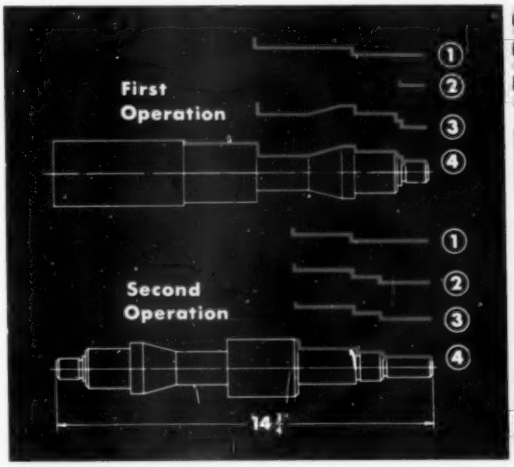
For the first operation, the rough bar stock is held between centers and driven by a work driver. As indicated in the drawing, one end of the part is rough and finish turned in four consecutive automatic passes. The tool post indexes automatically, presenting the finishing tool to the work for the final pass. At the same time, the grinding relief is formed from the rear independent slide. Floor-to-floor time: 3 minutes.

The second operation is equally easy and simple: the work driver jaws, templates and rear independent slide tools are changed—and the part is completed by four more automatic passes, with grinding reliefs formed from the rear independent slide during the finish turn. Floor-to-floor time: 2 minutes.

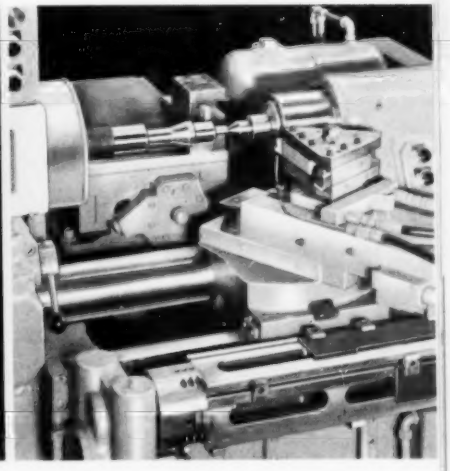
On this job, four consecutive automatic passes are made with four different templates to complete each operation.



New design refinements give Gisholt No. 12 MASTERLINE Automatic Production Lathe even greater capacity, versatility and ease of operation.



Special cam carrier indexes to present different template for each pass.



Closeup shows Gisholt JETracer Slide and automatic indexing tool post.

WITH THE GISHOLT MASTERLINE

MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

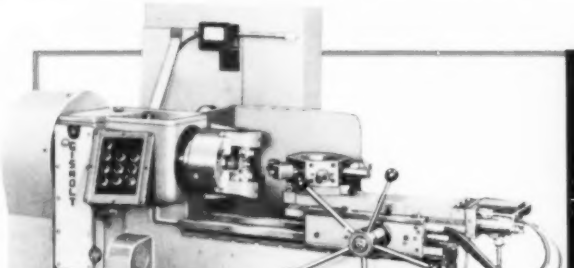
FOUR ENDS MACHINED IN SINGLE OPERATION

New Electram with pre-set controls boosts production

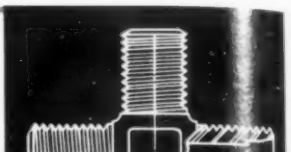
Here is a fast, positive, low-cost solution to handling parts requiring machining on two or more ends or sides—such as small to medium valves, tees, crosses, etc.

The machine is the new Gisholt MASTERLINE No. 3 Electram Lathe. The workpiece is a steel union cross tube fitting. All four ends are machined in a single chucking.

A Gisholt-Weatherhead Chuck is used to permit power indexing of the workpiece without stopping the spindle. Electrical controls at the rear of the turret ram are pre-set for each turret station and govern spindle speed, spindle reverse for tapping, spindle stop and single or double indexing of the hexagon turret.



New Gisholt No. 3 MASTERLINE Electram Lathe, showing setup for cross tube fitting.



Steel union cross tube fitting, showing surfaces machined on all four ends.

Hexagon turret tools face, chamfer, center, turn O.D., drill, form a 24-degree angle seat and a 15-degree angle bushing seat at all four ends. The workpiece is indexed in the chuck, so that tools on each hexagon turret station machine all four ends before indexing to the next turret station. To complete the part, all four ends are threaded, with the spindle reversing each time to withdraw the die head. Floor-to-floor time? Just 1.50 minutes.

Through this well-planned setup, multiple operations are handled on each of four ends of union cross tube fittings—with high volume output at lowest cost.

JETracer SAVES ON TIME, TOOLING COSTS, INSPECTION

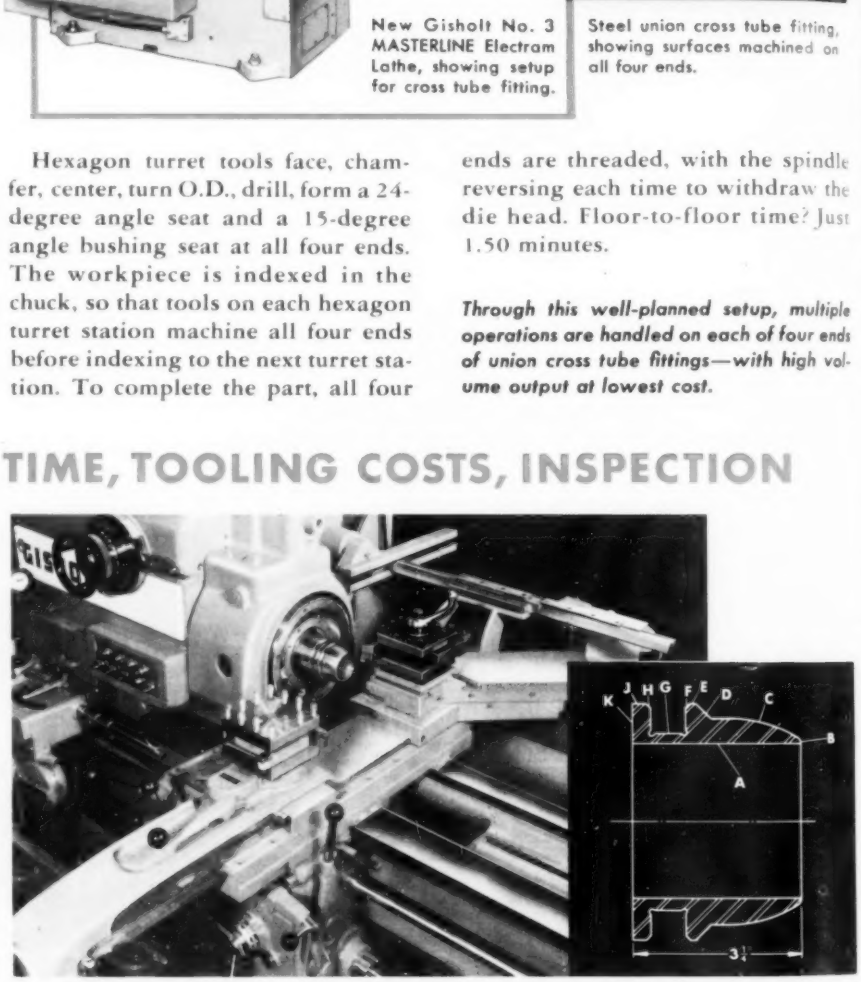
Simple application on Saddle Type Turret Lathe

The problem: how to machine steel bar feed wedges from 4½" diameter stock in one fast operation.

The solution: a new Gisholt MASTERLINE 2L Saddle Type Turret Lathe, equipped with a JETracer and a 40 HP motor.

To feed the 4½" diameter bar stock through the 4⅝" spindle bore, an outside operated collet chuck is used. The JETracer, mounted on the rear of a bridge-type cross slide, provides an economical means of accurately machining the contoured O.D. of the wedge. Considerable time is saved, tooling costs are reduced and inspection is greatly simplified.

Machining begins with the rough bar stock fed through the collet, against a hexagon turret stop. Other hexagon turret tools start drill, drill and rough and finish bore A. A single cutter turner reduces the stock O.D. in preparation for contour turning. Square turret tools rough and finish groove and chamfer F-G-H. The JETracer carries two tools (in an indexing-type square turret) which rough and finish generate B-C-D-E-J in two quick passes. The bar feed wedge is cut off at K from the front of the cross slide, and the job is finished. F.t.f. time is 8.50 minutes.



All surfaces handled in one fast operation. Close-up shows JETracer on rear of bridge-type cross slide.

Time is saved and inspection is simplified on this job through a most modern machine and smart tooling.

GISHOLT

TIME-SAVING IDEAS

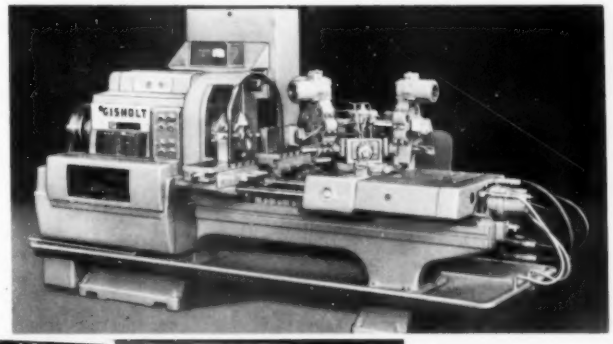
NEW FASTERMATIC CUTS SETUP TIME 50%

Simple toggle switches govern all machine functions

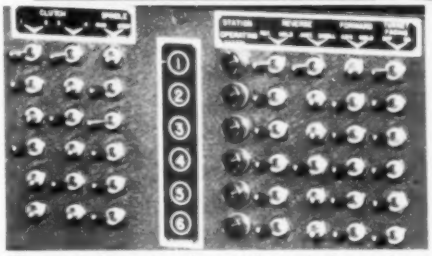
This new Gisholt MASTERLINE 2F Fastermatic Automatic Turret Lathe makes quick work of steel gear blank forgings. The secret is a new, electrically-controlled setup panel which simplifies and shortens set-up.

GEAR A—*Operation 1:* Hexagon turret fully tooled for both operations. Stations 3 and 6 bypassed. Stations 1, 2, 4 and 5 machine A-D-G-H. Cross slide tools machine B-C-E-F. F.t.f. time: 5.05 minutes. *Operation 2:* Change-over—one hour. Cross slide tools and chuck jaws changed, cross slides set to operate with stations 3 and 6. Stations 1, 2, 4 and 5 by-passed. Stations 3 and 6 machine M-J. Cross slide tools machine K-L-N-P. F.t.f. time: 1.50 minutes.

GEAR B—*Operation 1:* Change-over—1¾ hours. Adjust tools on stations 3, 4, 5 and 6 and change on stations 1 and 2 and on cross slides. Chuck jaws and spindle speeds changed and cross slides set to operate with stations 1 and 4. Stations 3 and 6 by-passed. Stations 1, 2, 4 and 5 machine A-F-G. Cross slide tools machine B-C-D-E. F.t.f. time: 5.75 minutes. *Operation 2:* Change-over—1 hour. Cross slide tools and chuck jaws changed, cross slides set to operate with stations 3 and 6. Stations 1, 2, 4 and 5 by-passed. Stations 3 and 6 machine M-H-J. Cross slide tools machine K-L-N-P. F.t.f. time: 1.39 minutes.

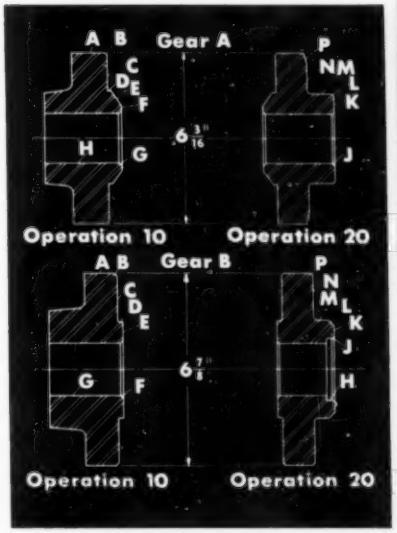


New Gisholt MASTERLINE Automatic Turret Lathe, designed to cut setup time 50%.



Close-up shows toggle switch control panel on new Gisholt Fastermatic.

Initial setup of the new Fastermatic is fast—simple toggle switches are set to govern all machine functions. On re-runs, a master reference card is used to further setup time.



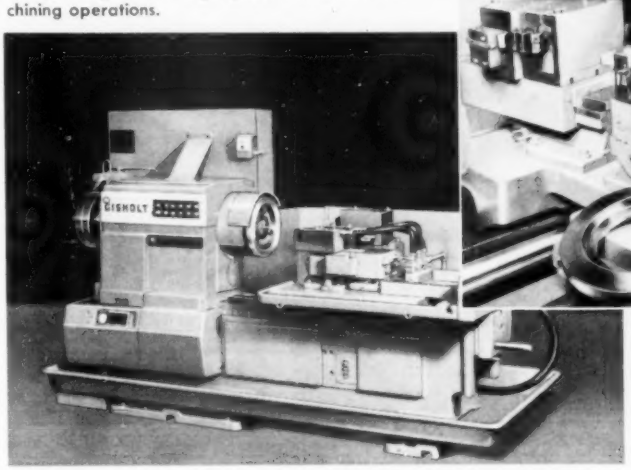
BEVEL GEAR FORGINGS IN 1.75 MINUTES F.T.F. TIME

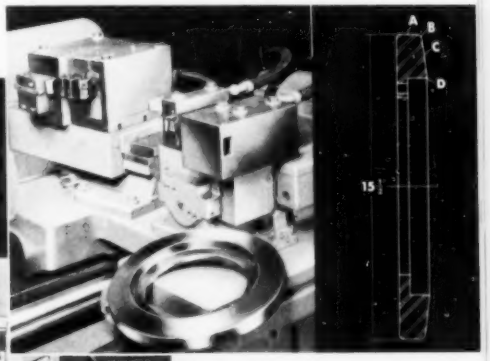
New MASTERLINE Simplimatic does low-cost job

Tough steel bevel gear forgings are a pushover on the new Gisholt Simplimatic Automatic Lathe.

Here's the operation: the part is centralized in the previously machined bore and chucked on the web in a draw-back clamp fixture. The platen table traverses forward, carrying slides and tools into position. The rear slide is set at the proper angle to machine the bevel face C. As the lead tool—held in a separate auxiliary slide—begins to feed, it is cammed to plunge into the face to roughing depth. Then, as slide movement continues, the lead tool feeds across with other rear slide tools following, to machine bevel face C and radius B. At the same time, front slide tools turn A and form radius D. F.t.f. time: 1.75 minutes.

New Gisholt MASTERLINE Simplimatic Automatic Lathe, designed for high-speed automatic machining operations.





Tooling setup for bevel gear job. Both slides have adjustable tops to speed tool setting. Rear slide has swivel base to simplify angular adjustment.

Fully automatic cycle of Simplimatic lets one man do two-man job; reduces f.t.f. time; cuts machining costs.

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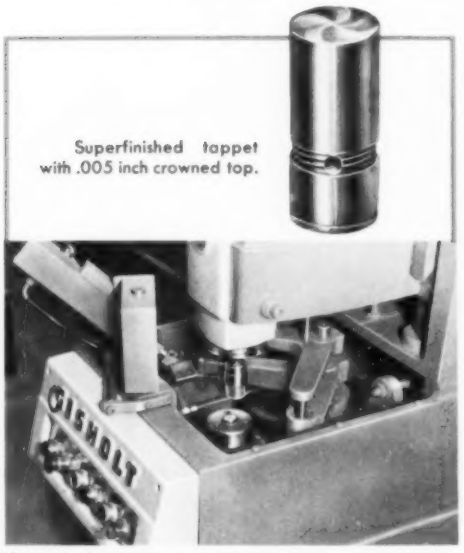
MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

HIGH-SPEED OUTPUT ON VALVE TAPP TS WITH NEW GISHOLT SUPERFINISHE

Fully automatic handling speeds Superfinis ing



Superfinished tappet with .005 inch crowned top.

Note cup-shaped stone over piece; pickup arms; ejector assembly and chamfer attachment.

New Gisholt MASTERLINE No. 81 High Production Superfinisher.

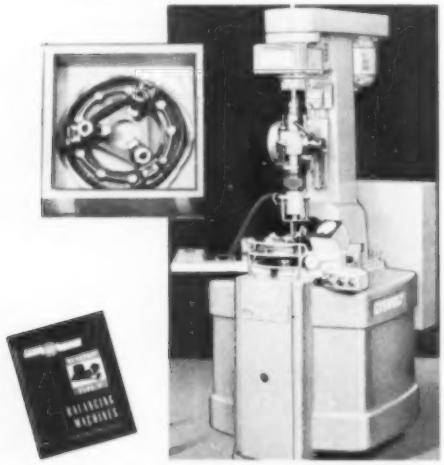
Here's how cast iron valve tappets are handled automatically on the new Gisholt MASTERLINE No. 81 High Production Superfinisher.

Cup-shaped stones are used, rotating off-center to generate a .005" crown on top of each tappet.

These parts are Superfinished from a flat ground surface down to 5 micro inches RMS or less. As each part is completed, a work transfer device with a left and right pickup arm is actuated. The left arm removes a rough part from a feeder conveyor, while the right arm receives the Superfinished part ejected from the spindle. Next, the transfer indexes so that the left arm is over the spindle and the right arm above a discharge conveyor. An ejector assembly pushes the rough workpiece into the spindle—the finished part onto the discharge conveyor. The transfer indexes to neutral, permitting the stone to engage the work. After Superfinishing, the stone retracts; a chamfering attachment operates, and the above cycle repeats. Floor-to-floor time is only 16 seconds per piece.

Superfinishing gives valve tappets longer life; automatic handling cuts costs.

Improved Gisholt Type 1SV1 DYNETRIC Balancing Machine setup for clutch and pressure plate assemblies (inset).



Write for free copy of Form 1165-A, the new Gisholt Type "S" Balancing Catalog.

No. 11-1255
643

LOCATES, MEASURES, CORRECTS, INSPECTS IN SINGLE HANDLING

Gisholt ISV1 DYNETRIC Balancer handles 90 parts an hour

This is an interesting example of how the 1SV1 Balancer cuts costs, by minimizing the motions demanded of the operator.

Here, clutch and pressure plate assemblies are rotated as the operator observes angle and amount of unbalance in the same visual field. One unit on the amount meter represents 1/32" drill depth of a 9/16" diameter drill at the radius of correction. A simple scale on the drill press assures drilling to depth indicated on the meter. Angular location is read on a dial under a stroboscopic lamp.

To correct for unbalance, the operator stops the spindle, positions the part for correction at the observed angle, and lowers the drill. A chip removal tube comes down with the drill and removes chips as they are formed. A thrust device supports the work. After correction, the part is again rotated to assure balance within tolerance. The 90 parts an hour are handled at 80% efficiency.

Equipping a standard balancing machine with simple attachments assures maximum production with minimum effort.

THE GISHOLT ROUND TABLE represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

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Use This MILL-M-MATIC to Increase Your Milling Production!

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25 H. P. SPINDLE DRIVE

MECHANICAL TABLE FEED

AUTOMATIC TABLE CYCLES

RIGID OVER-ARM

You owe it to your production program to get all the details on this new *heavy duty* series of bed-type Mill-M-Matics. They utilize 25 horsepower through the spindle drive. Electrically controlled movements are mechanical to insure maximum rigidity and effective production with accuracy. . . The new Mill-M-Matic is now offered in a full range of heavy duty sizes by Motch & Merryweather, foremost builder of *traveling head* milling machines.

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Builders also of Circular Sawing Equipment, Vertical Turning, Automatic and Special Machines

R-B Strippers Cut Costs

RUBBER STRIPPER

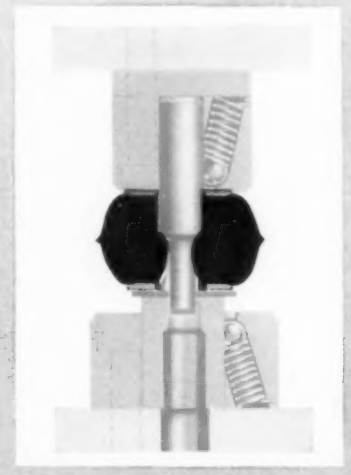
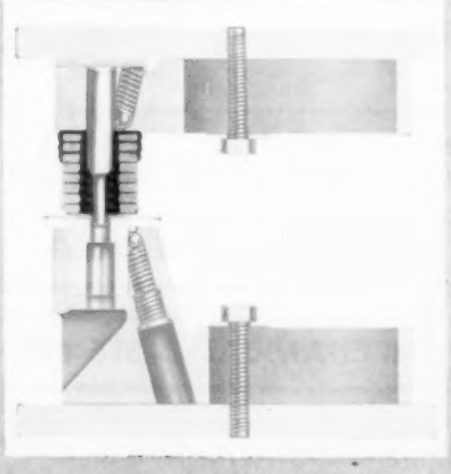


Illustration above shows rubber stripper on punch shank. In this type of application R-B strippers are held to punch shank by friction.

Stripping with R-B rubber strippers or R-B rubber covered spring strippers eliminates costly metal strippers. Both types of R-B strippers serve the same purpose—rubber strippers are used with smaller punches having shank diameters up to and including ⅝"; rubber covered spring strippers are recommended for punch shank diameters larger than ⅝". Use R-B strippers—to save the cost of making strippers—to substantially reduce installation time—for reduced maintenance.

RUBBER COVERED SPRING STRIPPER



To the right is a cross section illustration showing how rubber covered spring strippers (also rubber strippers) are used with R-B Flex-Mount retainers.

Use R-B Engineering Service for your Tough Piercing Problems

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ALLIED PRODUCTS CORPORATION
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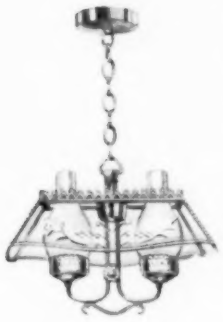
SHEET METAL DIES MADE OF FERROUS ALLOYS, ZINC ALLOYS OR PLASTICS

If you're eating your heart out over polishing costs---read this!



Skyrocketing enthusiasm of America's homeowners for high-quality solid-brass lighting fixtures created a temporary bottleneck in the polishing room of Globe Lighting Products, Inc., one of the leaders in the field. This production problem coincided with the introduction of Formbrite* to the metal-working industry a couple of years ago.

Globe's acceptance of this easy-to-polish fine-grain drawing brass was immediate and enthusiastic. Results were highly successful from the very beginning. Work pile-ups in the polishing room were eliminated and polishing costs were cut in half on many items (see typical examples below). In addition, Globe learned, as have many others, that Formbrite provides a more lustrous finish—is harder, stronger, springier and more scratch-resistant, yet has remarkable ductility for forming and drawing operations.

Surprisingly, Formbrite doesn't cost a penny more than ordinary drawing brass. Why not pass the good news along to those who head up your engineering, design or production departments? Ask them to write for booklet B-39 . . . or phone for a sales representative . . . or request a free sample of Formbrite to try in your own shop. Address: The American Brass Company, General Offices, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

5580

*Reg. U. S. Pat. Off.

Parts illustrated are approximately three-quarters actual size.

48% saving 5/16 x .062" round-edge Formbrite strip in this scroll eliminated a before-bending polishing operation.

26% saving Tens of thousands of these drawn canopies, socket cups, etc., have been made of time-and-cost-saving Formbrite.

45% saving After forming, this Formbrite channel edging is simply bright dipped, color buffed, degreased, lacquered. That's all!

55% saving This hard-to-handle ornamental banding now gets only a simple color buff, saving as much as the cost of the metal.

Formbrite

FINE-GRAIN DRAWING BRASS

an ANACONDA product

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The Success Story of **SPEEDKUT "A"**

. . . a boost for screw machine output!

The Success of SpeedKut A . . . is an oft repeated story of increased output, better tool life and less downtime. For SpeedKut A is one of Stuart Oil Company's balanced, general purpose cutting oils specifically designed for high speed machining of free-machining screw stock and brass on single spindle and multiple spindle automatic screw machines, turret lathes, milling machines, and hobbing machines.

SpeedKut A is a product of Stuart's sulphochlorination processing that provides absolute uniformity and stability. Highly effective chemical additive materials are pre-balanced under strict laboratory supervision to instill SpeedKut A with the anti-weld and friction reducing characteristics necessary to the range of machining operations for which it is recommended.

When selecting a cutting fluid, factors to be considered are material being machined, material hardness, speeds, feeds, depth of cut and machine design. Cullman Wheel Company, Chicago, Ill., a leading sprocket manufacturer, took all these factors into consideration more than 10 years ago. They chose SpeedKut A then and still use it for their multi-spindle automatics to cut sprocket blanks from free machining bar stock and for hobbing the sprocket teeth.

Your operation may be another link in this success story of SpeedKut A . . . or perhaps the factors that must be considered indicate a different type of balanced cutting fluid. "The Man in the Barrel", your Stuart Representative, will help you take all of the factors into consideration. Consult him. You'll be happy you did.

Write for Stuart's Cutting and Grinding Fluid Selector and Dilut-O-Graph Folder. It's a quick guide to starting recommendations for any job. Your name and title on a company letterhead is all that's needed.

D. A. STUART OIL CO. LTD.
2727-49 S. Troy St., Chicago 23, Ill.

More than a "Coolant" is Needed

Stuart Oils

Time Tested Cutting Fluids and Lubricants

Plants in: Chicago, Detroit, Cleveland, Hartford, and Toronto, Ontario.

Branch Warehouses and Representatives in principal metal working centers in the United States, Canada and Europe.

A NEW KIND OF END MILL JOINS THE BROAD ILLINITE® LINE

TRI-MIL* END MILL

a versatile end mill with a complete range of flute lengths... in a single tool!

Here's a new end mill with cutting edges running its entire length . . . having a productive life as long as its length! The advanced adapter design permits gripping at *any* position on the mill and can be located closer to work surface for greatest rigidity.

Tri-Mil is a combination of four conventional end mills: stub length, regular length, long and extra long. It's the perfect cutting tool for every slotting operation.

Ask your Illinite distributor for this Tri-Mil brochure.

Tri-Mil and all famous Illinite End Mills are available in a full range of types and sizes from your local ILLINITE END MILL DISTRIBUTOR. Call him today!

ILLINITE OFFERS THE MOST COMPLETE LINE OF END MILLS

ILLINOIS TOOL WORKS

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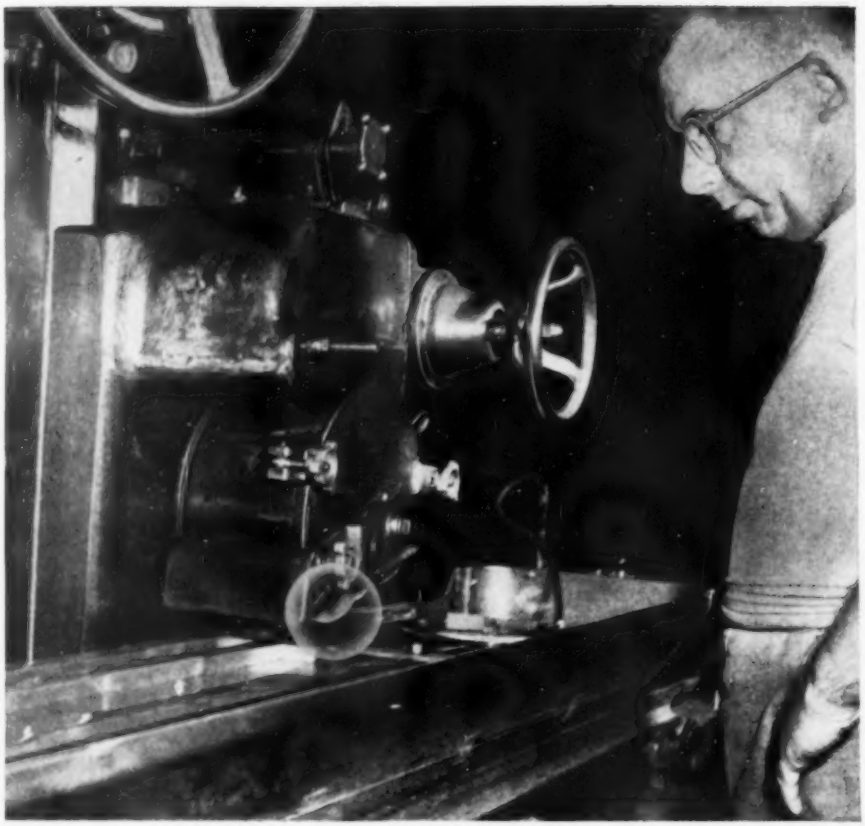
*TRADE MARK



"Competitive wheels have never equalled G Bond wheels on our jobs." This Massachusetts tool manufacturer further reports he considers G Bond wheels as maximum load production wheels, extremely free cutting, requiring little dressing and giving very long life. His requirements are precision grinding hard steel to a very high finish, and to parallel tolerances of .0001".

Grinding precision spur gears of SAE 8620 steel, hardened to 59-63 Rockwell C, this Maryland pump and motor builder thoroughly tested G Bond wheels against other makes. He reports that G Bond wheels cut cooler, hold form much better, last 50% longer due to less frequent dressing, and are easier on diamonds.

Jigs, fixtures and other parts of miscellaneous steels, besides some of cast iron, are the jobs on which G Bond segments are used by this Ohio tool and gage maker. He credits the G Bond segments with giving a better finish, with less dressing, than any he previously used.

Better surface grinding for you... G BOND users' reports prove it!

Top speed, new economy among many "TOUCH of GOLD" *advantages listed*

Reports from surface grinding customers on the performance of G Bond wheels sound pretty much alike. That's logical, because each customer is getting exactly the advantages he's looking for — *freer, cooler, faster cutting action . . . heavier cuts without burning . . . closer tolerances and smoother finishes . . . easier dressing and more pieces per dressing . . . more work, and more kinds of work, per wheel.*

Your Own Surface Grinding

will benefit by the G Bond's unique ability to hold each abrasive grain just long enough for maximum cutting action — an important "Touch of Gold" advantage that means time and money saved, plus better product quality, throughout the range of precision and semi-precision grinding jobs.

See Your Norton Distributor

for the G Bond wheels, cylinders and segments you need. They're available in a variety of famous Norton abrasives. Of these, 32 ALUNDUM* abrasive is particularly suited for fast stock removal and heavy feeds — it grinds exceptionally cool and fast, with minimum dressing.

And remember: only Norton offers you such long experience in both grinding wheels and grinding machines to help you produce more at lower cost. NORTON COMPANY, Worcester 6, Mass. Distributors in all industrial areas, listed under "Grinding Wheels" in your phone directory, yellow pages. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass.

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

NORTON

Making better products... to make your products better

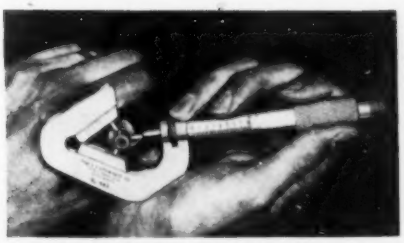
and its BEHR-MANNING division

W-1646

NORTON COMPANY: Abrasives • Grinding Wheels • Grinding Machines • Refractories
BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure Sensitive Tapes

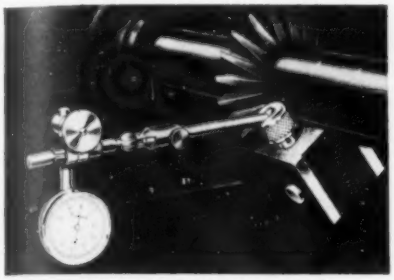
new Starrett TOOLS for every department

In the big new Starrett 75th Anniversary Catalog you'll find many new tools like these . . . plus thousands of other items to help you do precision work faster, better and at less cost. Ask your Starrett Distributor or write for your free copy. Use the coupon.



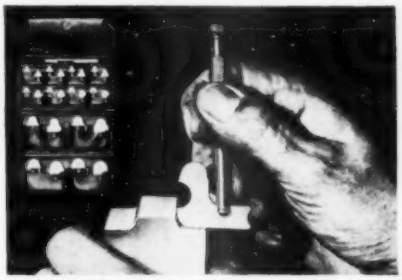
NEW ODD FLUTE MICROMETERS

No. 483 and No. 485 measure 3 or 5-fluted cutting tools. Read direct in thousandths, eliminate special fixtures. Satin Chrome Finish with carbide facings on anvil and spindle.



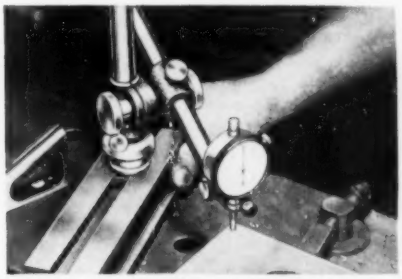
NEW MAGNETIC BASE INDICATOR HOLDER

No. 657 holds firmly to any iron or steel surface. Use with any Starrett "Last Word", No. 196 or No. 25 Series dial indicator. Universally adjustable with on-off push button.



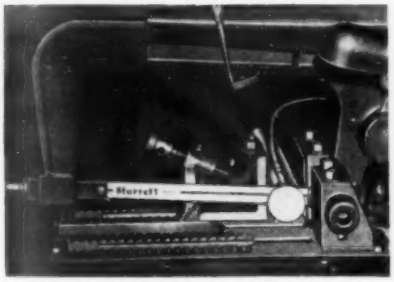
NEW STAINLESS STEEL RADIUS GAGES

No. 167. Sets of individual gages, each with five gaging surfaces for convex or concave radii. Made of rustproof stainless steel with Satin Finish. Six convenient sets.



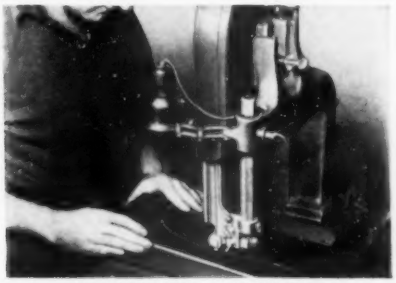
NEW DIAL TEST INDICATORS

like this No. 675 simplify layout, production and inspection. And don't forget the complete new line of Starrett high precision-low friction dial indicators.



NEW HACKSAWS, BAND SAWS, HOLE SAWS and BAND KNIVES

are Production-Proved for better cutting, longer life. Starrett hacksaws are now color-identified to help select the right blade for any job.



PRECISION GROUND FLAT STOCK

and Die Stock saves valuable machine and man hours. Available in oil, oil or water, water hardening or air hardening types. "Just lay it out . . . and saw it out."

NEW "KLEENSCRIBE" LAYOUT DIE

is specially prepared for layout work. Dries instantly to an opaque, no-glare blue finish. Makes scribed lines stand out sharp and clear. 4 fluid ounce can with brush in cap.

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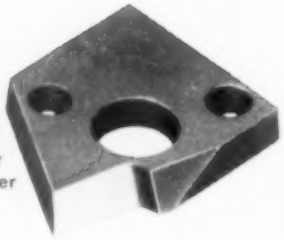
when toolholder accidents happen

hardened steel screws

Replace a Part

...not the toolholder

wear resistant cast alloy chipbreaker



ONLY THE V-R TOOLHOLDER HAS THE REPLACEABLE ELEVATOR

Most toolholder accidents or wrecks result in damage not only to the insert but to the shank immediately below the insert. When this happens with a V-R toolholder the damage is usually confined to the elevator which is easily replaced or repaired at a fraction of the cost of a complete toolholder.

solid carbide "throw-away" insert

hardened steel elevator

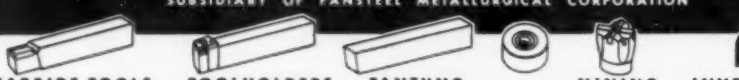
Ask your nearest V-R representative to explain the "replacement story" and how it can lower your tooling costs.

For the name of your V-R representative, write today.

V-R Toolholders are Available in Negative or Positive Rake in a Wide Range of Styles and Sizes

Vascoloy-Ramet CORPORATION

SUBSIDIARY OF FANSTEEL METALLURGICAL CORPORATION



MANUFACTURERS OF CEMENTED CARBIDES • CARBIDE TOOLS AND BLANKS • TOOLHOLDERS AND INSERTS • TANTUNG TOOLS • DIES • MINING TOOLS • INVESTMENT CASTINGS

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NOW

MILL OR GRIND

EXTERNAL or INTERNAL CONTOURS

(CAMS, TEMPLATES, BLANKING PUNCHES AND DIES)

- DIRECTLY FROM SIMPLE LINE DRAWINGS
- WITH EXTREME ACCURACY
- IN MINUTES INSTEAD OF HOURS
- WITH NON-CONTACTING TRACER CONTROL

the ALL NEW Model 104 electronic CAM and TEMPLATE Machine

Using a new and unique non-contacting tracer control, the Model 104 works direct from simple, large-scale line drawings easily prepared with electrically conductive "ink". The contour of the drawing is reproduced at the milling head at **any reduced** scale, such as 5:1, 10:1, 20:1, or higher. Any errors in the drawing are proportionately reduced, resulting in extreme accuracy of the workpiece. Since neither model nor complex tooling-up is required, production costs are minimized. Built for continuous, heavy-duty operation, the Model 104 provides a wide range of spindle speeds (48 to 11,500 rpm) and ample power to assure efficient milling or grinding of practically any desired metal or alloy.

If you are producing external or internal cams, templates, and blanking punches and dies of irregular, complex shape . . . here are important opportunities for added precision, reduced production time, and cost savings never before possible!

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Sales . . . and Complete Sales Engineering and Maintenance Service . . . Through

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Please send my free copy of Circular No. 579 fully describing the Model 104 Cam and Template Machine.

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let us open our hearts
and homes to the
Brightest Gift of All...
The True Spirit
of
CHRISTMAS
MORSE TWIST DRILL & MACHINE COMPANY · NEW BEDFORD, MASSACHUSETTS

Guarantee TOP Performance and Maximum Life!

Specify THESE TOP QUALITY FEATURES...

(Standard on Miller Cylinders at no extra cost)

Specify CASE HARDENED CHROME PLATED PISTON RODS

On all Air and Hydraulic Cylinders

Benefits To You

CASE-HARDENED Piston Rods (52-54 Rockwell "C") provide practically complete protection against damage from hammer blows, wrench-dropping, mishandling, and similar occurrences. ***Available from Miller at no extra cost.***

The HARD CHROME PLATING over the case-hardened rods protects against scratch-damage and rust. ***Available from Miller at no extra cost.***

Specify "TEFLON" WIPERS

On all Air and Hydraulic Cylinders

Benefits To You

"TEFLON" Rod Wipers and "TEFLON" Hydraulic Piston Rod Seals withstand temperatures from—100°F. to plus 500°F. They are impervious to practically all known chemicals, including the fire-resistant, special, and standard hydraulic fluids in current use. ***Available from Miller at no extra cost.***

Specify TEFLON HYDRAULIC ROD SEALS

On all Hydraulic Cylinders

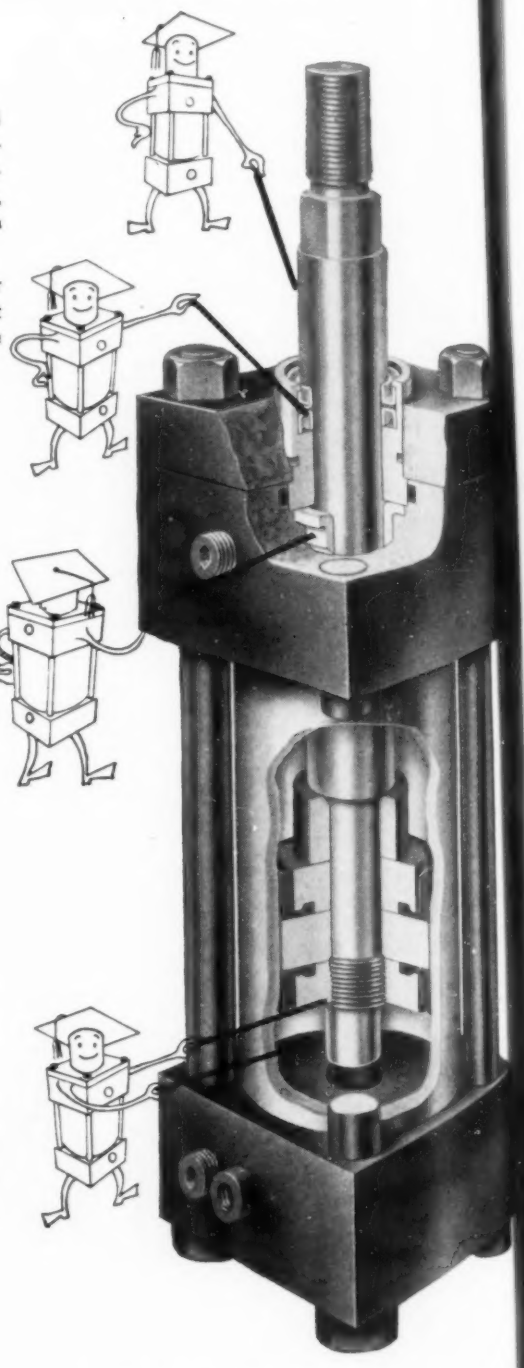
Specify RUST RESISTANT SURFACES

On all Air and Hydraulic Cylinders

Benefits To You

Highest quality Black Ferric Oxide Finish provides rust protection in air cylinder operation and on all cylinders during shipping and installation.

Cylinder heads, caps, mountings, pistons, followers, tie rods, and the unplated portions of the piston rods have this finish ***at no extra cost on all Miller cylinders.*** (This finish not recommended for water service)



You may wish to route this entire page to the proper department in your company, by using this handy form. Additional copies on request. →

To (Dept.)_____

"On all our future cylinder requirements, please specify the above quality features."

Signed_____

Title_____

EFFECTIVE DATES

These new Miller features will be provided at no extra cost after January 1, 1956—and at Miller's option prior to that date.

SALES AND SERVICE FROM COAST TO COAST

CLEVELAND • YOUNGSTOWN • DAYTON • TOLEDO • CINCINNATI • COLUMBUS
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Miller

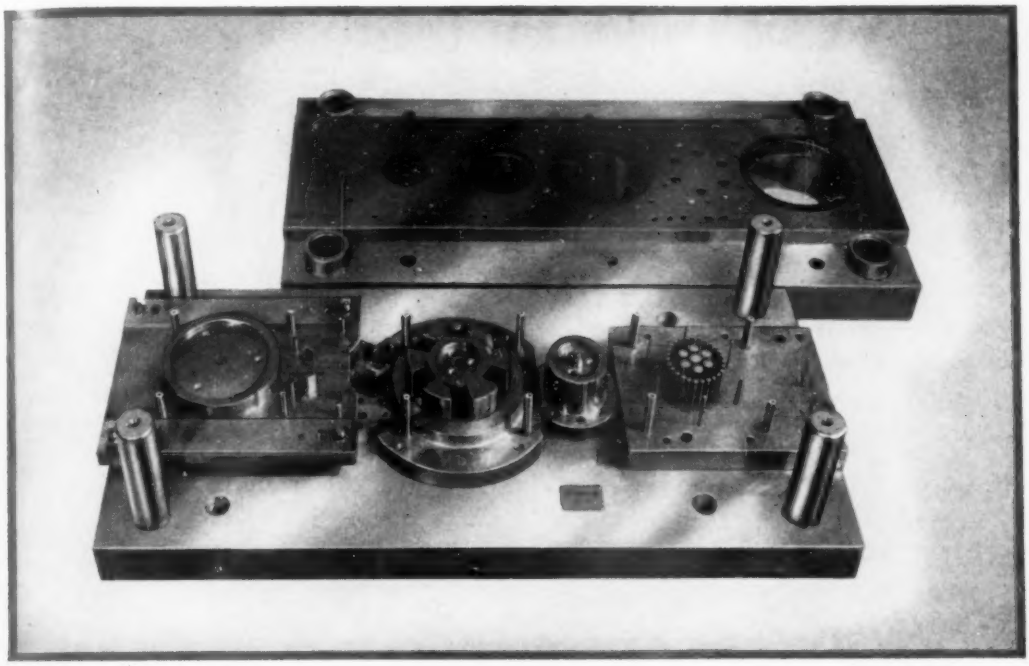
MILLER FLUID POWER C

2010 N. Hawthorne Ave., Melrose Park, Ill.

AIR & HYDRAULIC CYLINDERS • BOOSTERS • AC ULATO

Although a steel die costs
less initially, this . . .

Carbide-equipped die pays off by outproducing steel die 10 to 1



Precision lamination die, equipped with Carboloy cemented-carbide cutting edges. Produces one million rotor and stator parts per grind, compared to only one hundred thousand per grind with a steel die.

The initial cost of this lamination die equipped with Carboloy® cemented carbide is about twice that of a steel die. But because the carbide die produces 10 times as many parts per grind, the initial investment is more than returned in downtime and grinding savings alone.

This is what the 10 to 1 ratio means to a plant: grinding expense reduced 90%; downtime reduced 90%; output per shift increased; grinding facilities freed for other tasks; scrap reduced because the carbide die holds its accurate tolerances longer; costly finishing work eliminated because parts are burr-free.

Actually, this case history is one of the less spectacular recorded on dies equipped with Carboloy cemented carbide. On many applications – large and small, simple and complex – carbide dies outproduce, outlast steel by margins as high as 50 to 1.

No matter what the job – drawing, forming, blanking, or piercing – Carboloy carbide-equipped dies have more than proved their value. Consult a Carboloy Engineer today. He will be happy to work with you or your diemaker on design and application problems. For more information, write or send the coupon below.

"Carboloy" is the trademark for products of the Carboloy Department of General Electric Company

CARBOLOY

DEPARTMENT OF GENERAL ELECTRIC COMPANY
11101 E. 8 Mile Street, Detroit 32, Michigan

- ☐ Send me Carboloy Die Engineering Manual D-124.
- ☐ Send complete details on Carboloy Die Training School.
- ☐ Have a Carboloy Die Engineer call at my plant.

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CARBOLOY CREATED-METALS FOR INDUSTRIAL PROGRESS

CINCINNATI RIGID SHAPERS

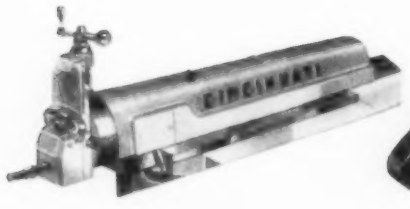
New—modern—these Rigid Shapers offer faster, more convenient controls, greater accuracy, greater dependability. The New nodular iron ram, trunnion and vise, and wide heavily ribbed column give a new rigidity—increase accuracy in cutting.

The New slot-free ram also eliminates the manual clamping of ram adjustment—a time saving feature.

A speedy, dependable electro-magnetic brake and clutch insure a faster performance.

50 P.S.I. pressure lubrication, exclusive on Cincinnati Shapers, is a real insurance against wear and a guarantee of long trouble-free performance.

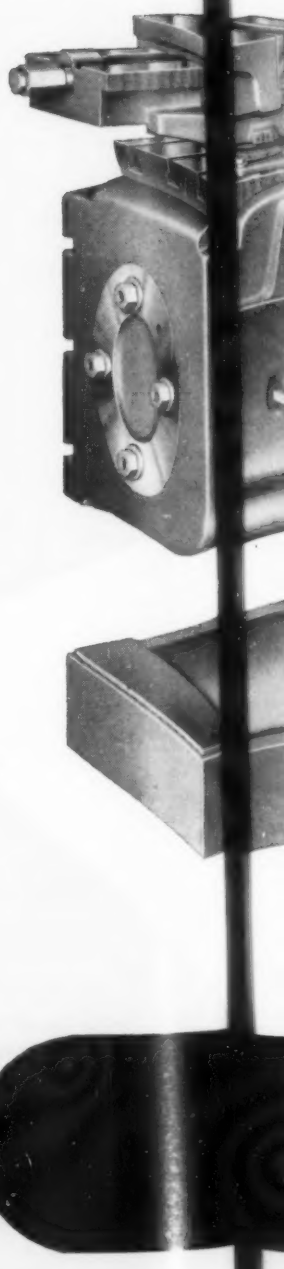
Write for the circular on the New Rigid Shapers.

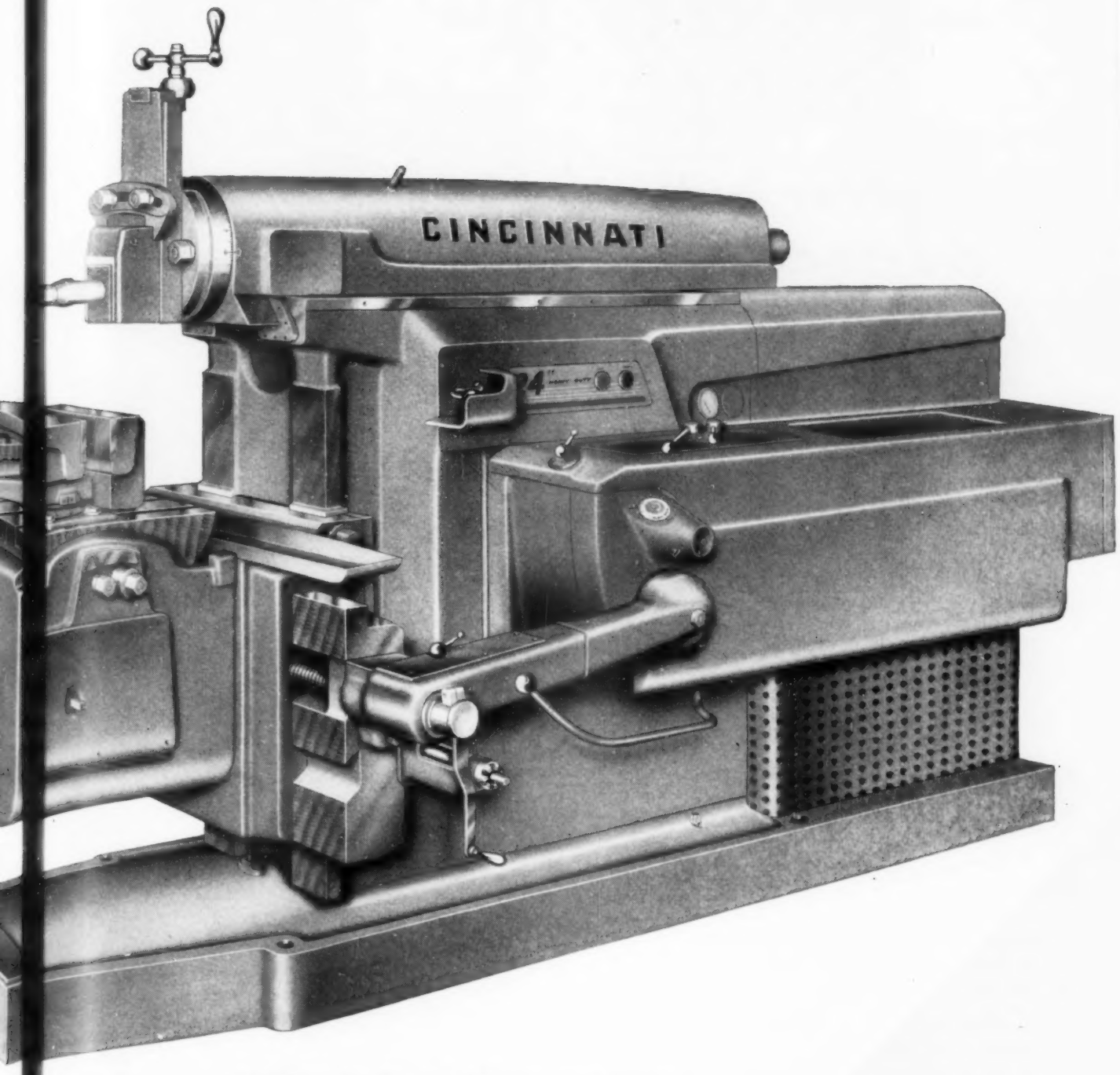


Nodular iron, slot-free ram

Electro-magnetic Clutch and Brake

The only shaper with 50 P.S.I. lubrication





Cincinnati Shapers, Shears and Press Brakes carry a 5 year guarantee on workmanship and material—write for details.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

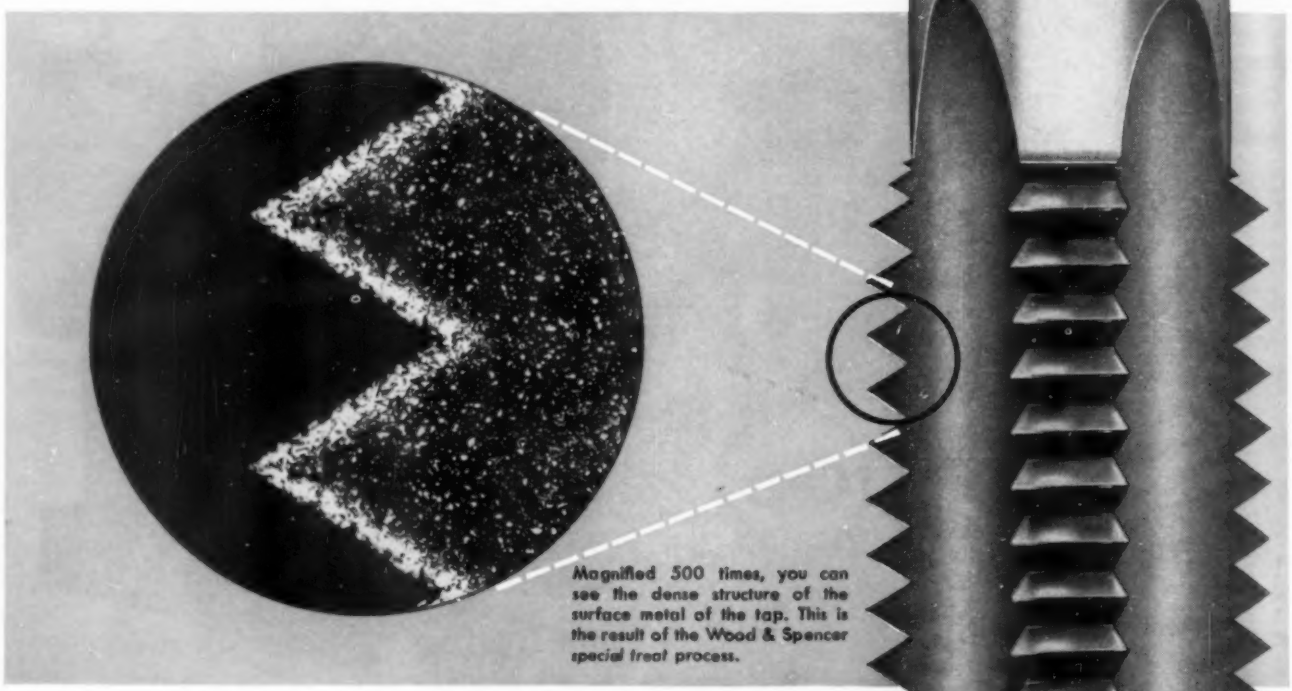
CINCINNATI

Wood & Spencer

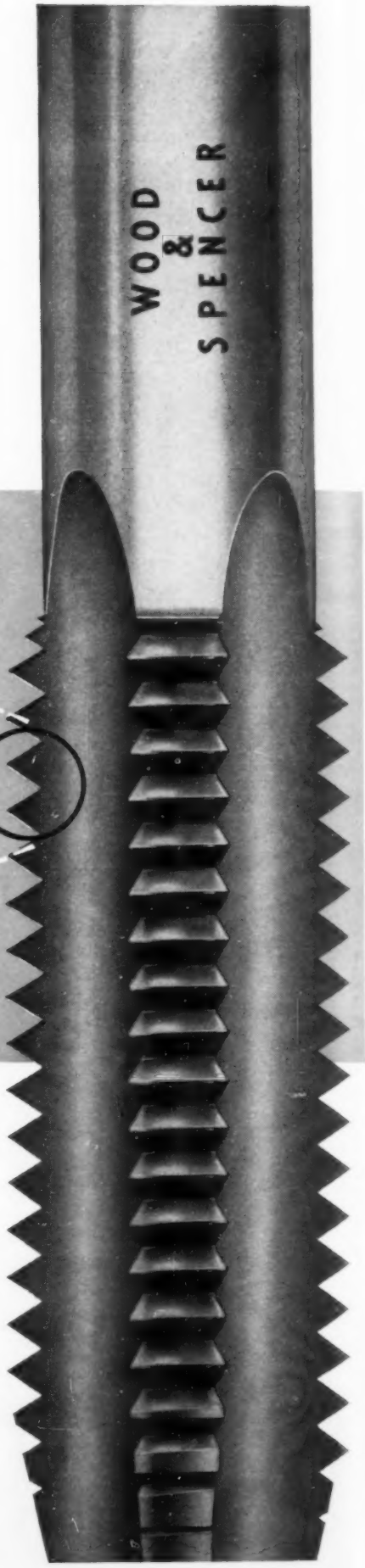
STANDARD TAPS SPECIAL

...offer extra Surface Hardness

to preserve cutting accuracy



Magnified 500 times, you can see the dense structure of the surface metal of the tap. This is the result of the Wood & Spencer *special treat* process.



Beyond the standard heat-treating process is a *special treat* we use on some taps, to give them even more resistance to wear. This additional process imparts an extra surface hardness. The added wear resistance results in a tool which will endure especially demanding production runs . . . and retain threading accuracy throughout.

We recommend these taps mostly for *problem alloys* or for grueling production runs . . . although you may want them for other applications.

We call this additional treating process by the unglamorous name *"special treat."* That's what you ask for when you order. Why not try these extra long-wearing, *special treat* taps? We'll be glad to supply your needs.

Want a free tap guide: Everyone who has one finds this handy wall chart an excellent ready-reference. It tells all standard gage tolerances, class fits and tap tolerances. Write us for one on your business letterhead.

The Wood & Spencer Company • Cleveland 3, Ohio

SNYDER TOOL and ENGINEERING COMPANY

As a fitting climax to our thirtieth
year, we are happy to announce
sions which will add about one
machine shop and assembly flo
which will enable us to add to
machining equipment and accom

OMPANY

As a fitting climax to our thirtieth anniversary year, we are happy to announce plant expansions which will add about one third to our machine shop and assembly floor areas and which will enable us to add to our precision machining equipment and accommodate more manpower. We are happy, too, to take this opportunity to thank all our friends who have made this modern plant possible—our customers, our suppliers and all of the hundreds of members of the Snyder family of workers, here and throughout the country.

SNYDER SEGMEN

AUTOMATION in 91

182 operation, in-line transfer

features four segments wh

operate independently or as a

assure continuous production

motive automatic transmission

100 cases an hour at 80% ef

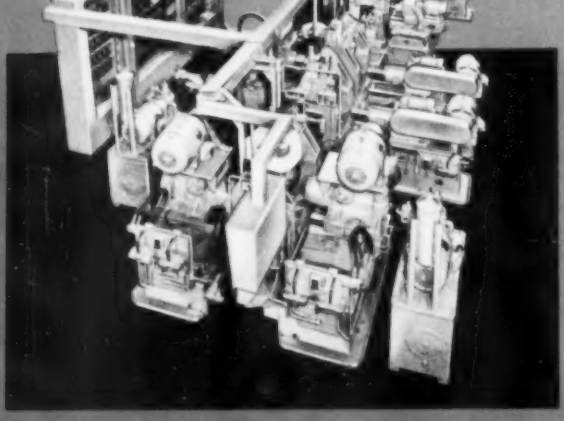
SNYDER

TOOL & ENGINEERING COMPA

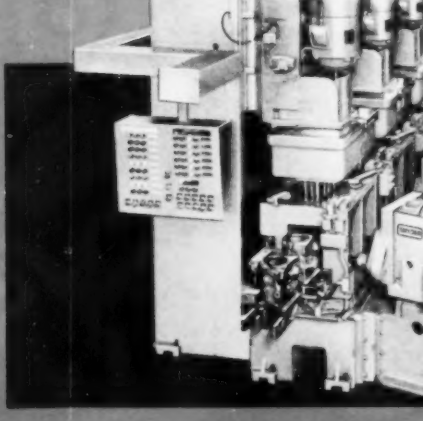
3400 E. LAFAYETTE, DETROIT 7, MICHIG

30 Years of Successful Cooperation with Leading Ame

SEGMENT 1: 40 feet long, 19 stations, 10 spindles. Part manually loaded, both ends face milled, counterbored, three diameters rough and finish bored and faced, two pads side milled, pump pad face milled, clearance slot milled. Part tilted 90 degrees in processing.



SEGMENT 2: 47 feet long, 31 stati face, end and at angular location drilled, countersunk, semi-finish ar faced, tapped. Part is tilted 90 degr



NTED

91 station,
r machine
hich can
a unit to
of auto-
n cases at
efficiency

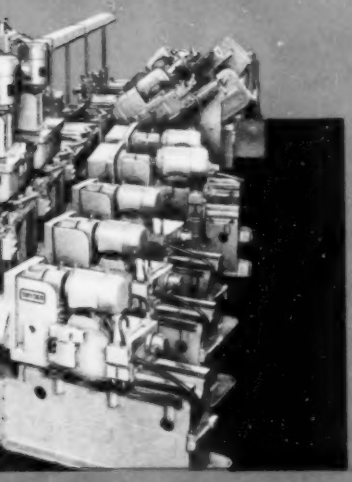
R

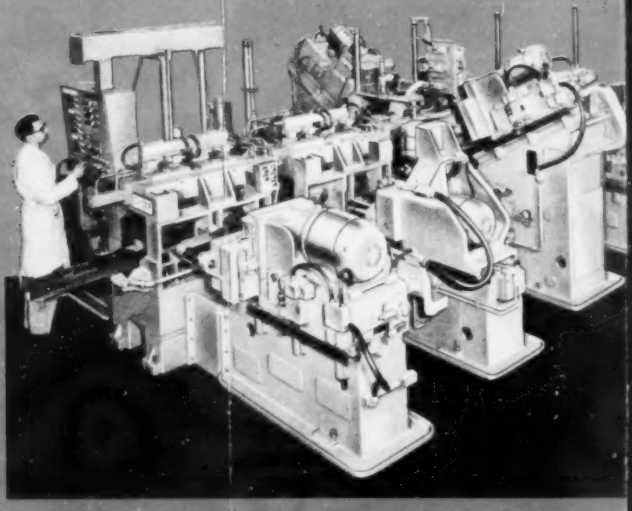
PANY
HIGAN

American Industries

SEGMENT 3: 26 feet long, 17 stations, 21 spindles. Various drilling, chamfering, tapping, counterboring, reaming, spotfacing operations in both case sides. Part removed from transfer bar to special fixture and tipped 45 degrees to process angular inside hole, returned to transfer bar, turned 90 degrees, tilted 90 degrees to bring pump face up.

stations, 91 spindles. In top
tions inside, 51 holes are
n and finish reamed, spot-
degrees and rotated.





...ENTED

...n 91 station,
...sfer machine
... which can
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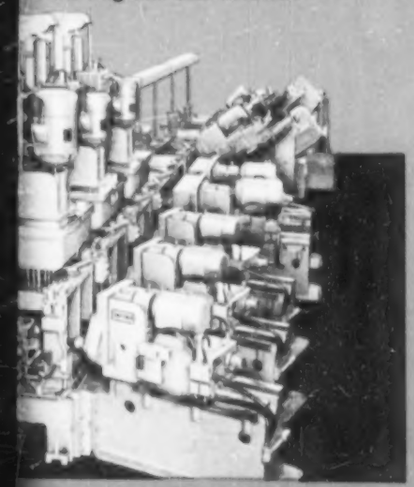
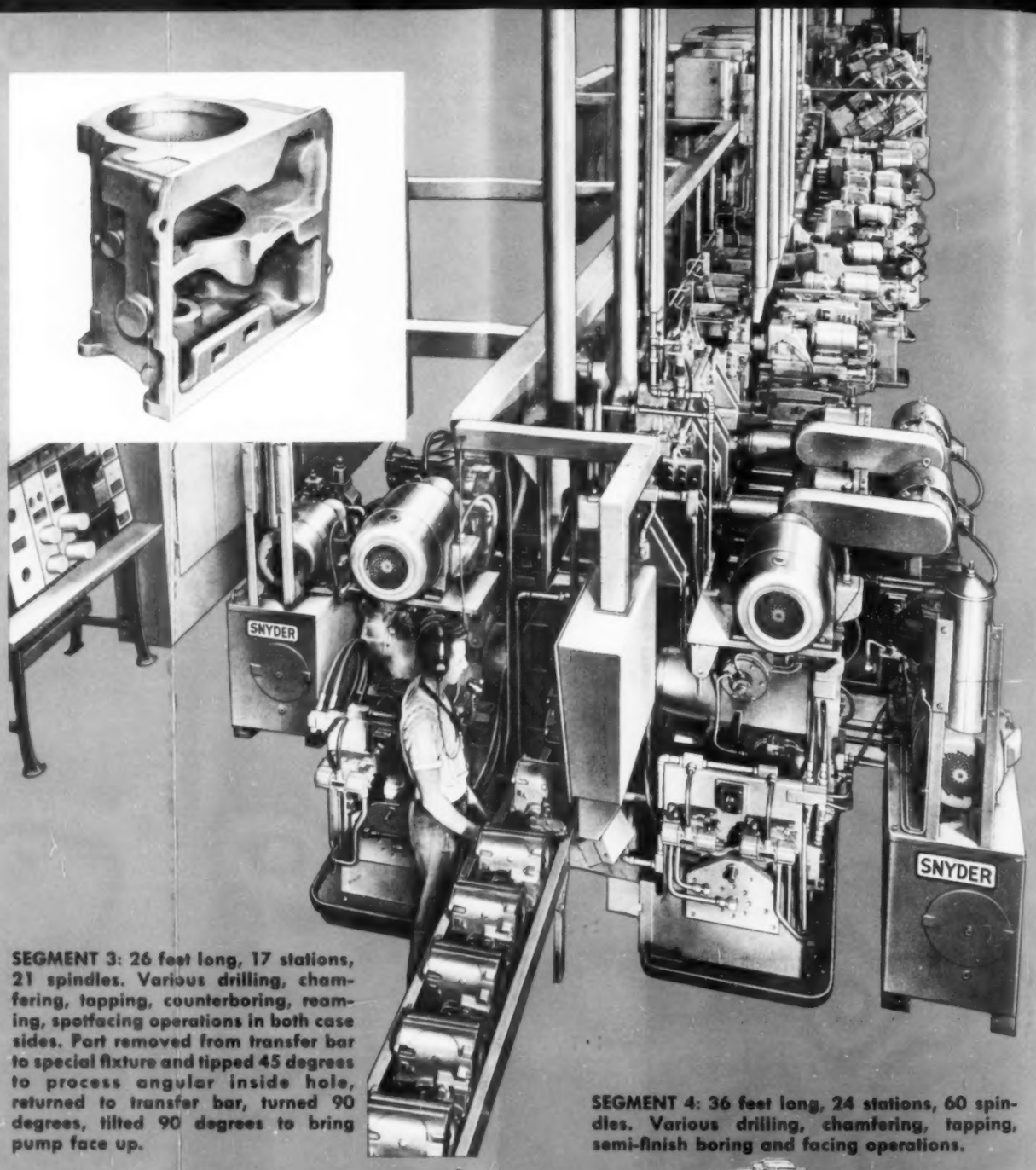
...g American Industries

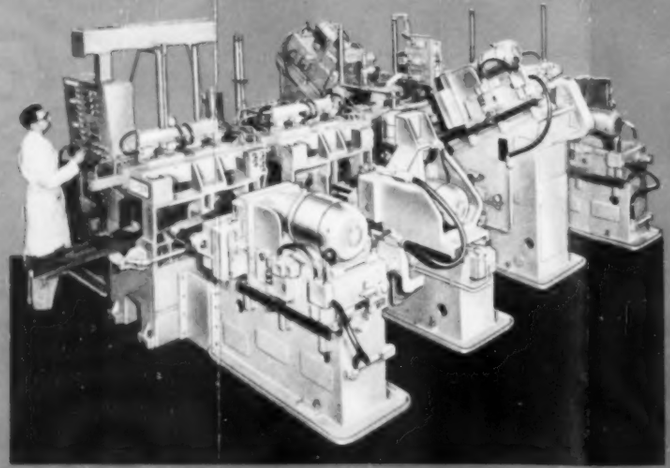
...g, 31 stations, 91 spindles. In top ...ar locations inside, 51 holes are ...ni-finish and finish reamed, spot-...ed 90 degrees and rotated.

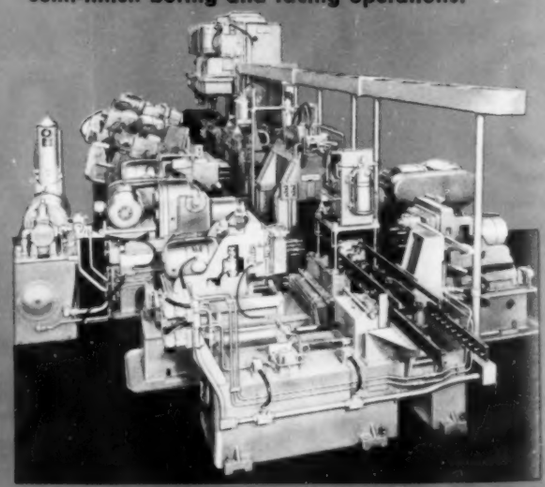




SEGMENT 3: 26 feet long, 17 stations, 21 spindles. Various drilling, chamfering, tapping, counterboring, reaming, spotfacing operations in both case sides. Part removed from transfer bar to special fixture and tipped 45 degrees to process angular inside hole, returned to transfer bar, turned 90 degrees, tilted 90 degrees to bring pump face up.

SEGMENT 4: 36 feet long, 24 stations, 60 spindles. Various drilling, chamfering, tapping, semi-finish boring and facing operations.





Tool Steel Clinic on Two Feet

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Your local Milne man is a tool steel specialist, trained to help you solve your tool material problems. He's an expert in tool steel characteristics and applications who can help specify exactly the right steel for the job.

He represents MILNE, America's Leading Tool Steel Specialists. That means he has a tremendous range of grades, sizes, shapes and finishes of tool steel to draw upon, including many unusual ones that are hard to find elsewhere.

Milne has grown up in the tool steel business. Its CONCENTRATION and SPECIALIZATION on this field is reflected in the variety of its warehouse stocks and the special knowledge in the minds of its representatives.

If tool steel is involved, call in a specialist ... call MILNE.

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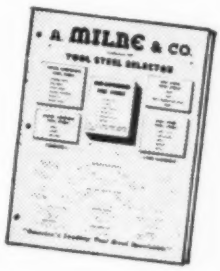
Includes several newly developed Milne tool steels

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Complete Line of Tool Steels & Wide Range of Sizes and Grades

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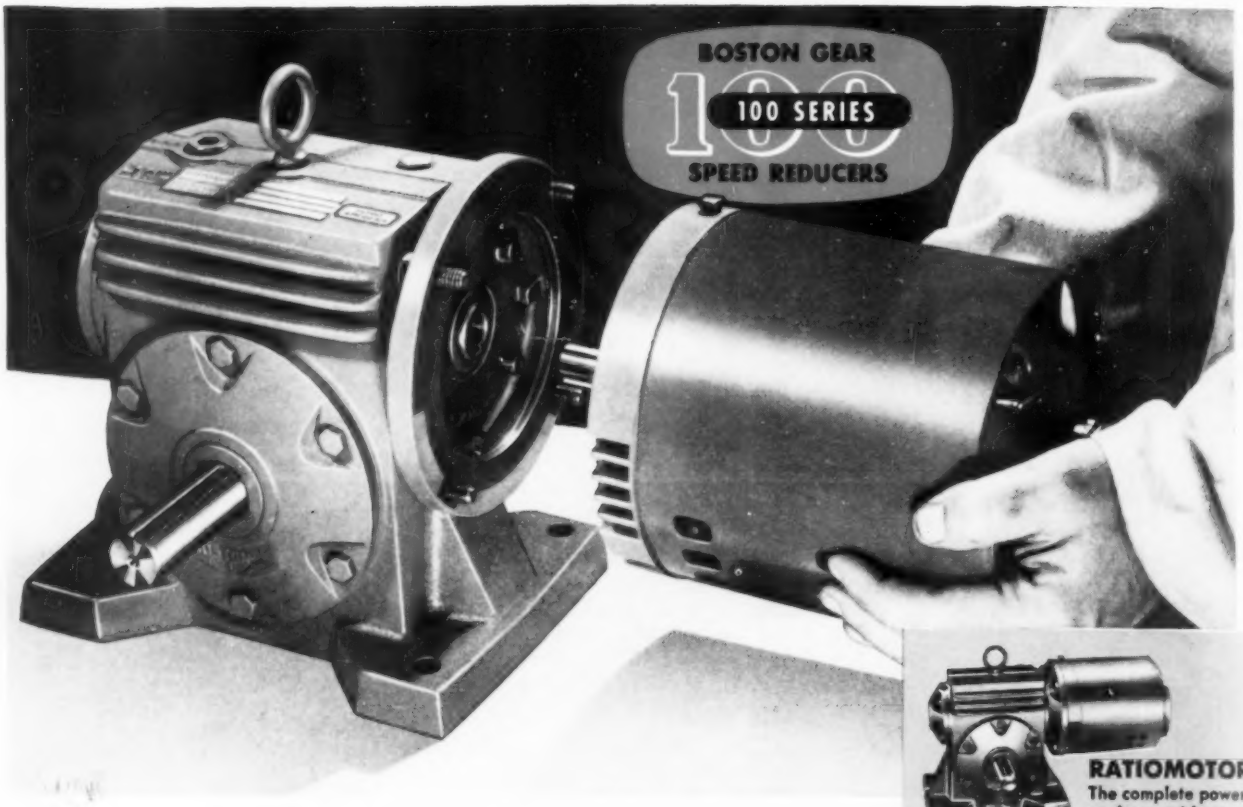

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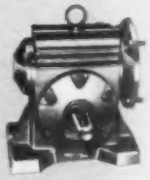

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For mechanical drives, new 100 SERIES design saves space and weight. Housings are finned for improved cooling. Fan-cooling optional on larger sizes.

MAXIMUM HORSEPOWER PER DOLLAR
Certified
by Independent Laboratory tests

New COST-SAVING "COMBINATION"

for certified efficiency—easy maintenance —and unlimited adaptability

The new 100 SERIES RATIOMOTOR combines a gear reduction unit and an easily detachable, standard end-mounted motor.

MOTOR CAN BE REMOVED and replaced in a few minutes, without disturbing the gear reduction unit. Saves maintenance time, preserves alignment, permits continued operation with spare motor.

ORIGINAL MOTOR CAN BE CHANGED When conditions require change to a motor of special characteristics (totally enclosed, explosion-proof, etc.) it can easily be attached in place of the original motor.

ANY MODEL NEEDED – FROM STOCK The 100 SERIES includes 1064 different *standardized stock* units for an unlimited range of applications . . . Reductors, for mechanical drives, as well as Ratiomotors and Flanged Reductors. All ratings are *certified* to be actual torque delivered, by Independent Laboratory tests.

A BOSTON GEAR FIELD ENGINEER will help you simplify planning, and put your product ahead in design. Your Boston Gear Distributor will arrange a call, or write: Boston Gear Works, 83 Hayward St., Quincy 71, Mass.

GET NEW CATALOG R-56

Lists models for any drive . . . horizontal or vertical—right angle or parallel—single or double reduction. Includes selection charts, engineering data.

1064 DIFFERENT UNITS
108 MODELS – FROM STOCK

Call your **BOSTON** *Gear* **DISTRIBUTOR**

For nearest distributor, look under "GEARS" in the Yellow Section of your Telephone Directory.

PATENTS PENDING

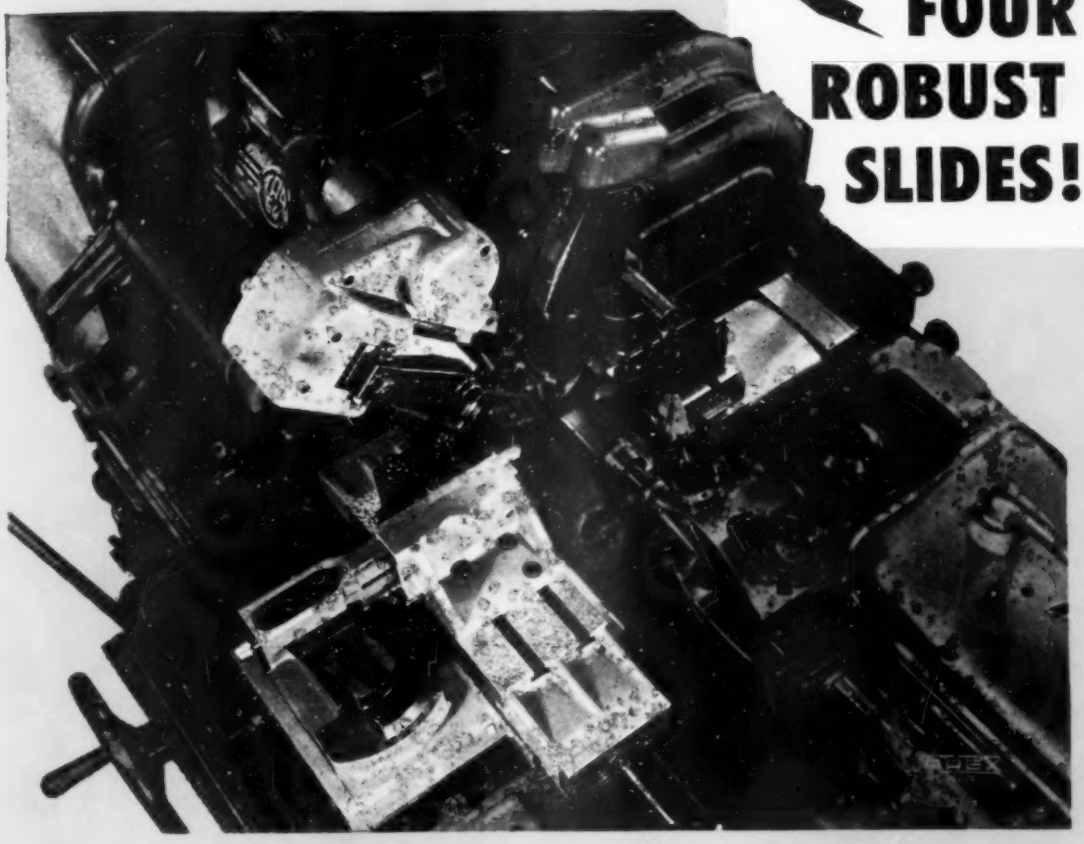
55-BG-R-17A

TAREX

AUTOMATICS

. . . here's JUST ONE of the salient features of this machine which is made with SWISS PRECISION throughout:

FOUR ROBUST SLIDES!



The front and rear slides mounted on crossed ways, *permitting radial or lateral movements, or combined to produce tapers or irregular forms.* This allows the use of single point tools in many cases in place of form tools with their inherent side thrust. All tool slides actuated by camming systems having adjustable ratios. (The two upper slides are radial only). Machine throughout is engineered to take American-made tools!

COMPLETE TOOLING and SERVICE in AMERICA.

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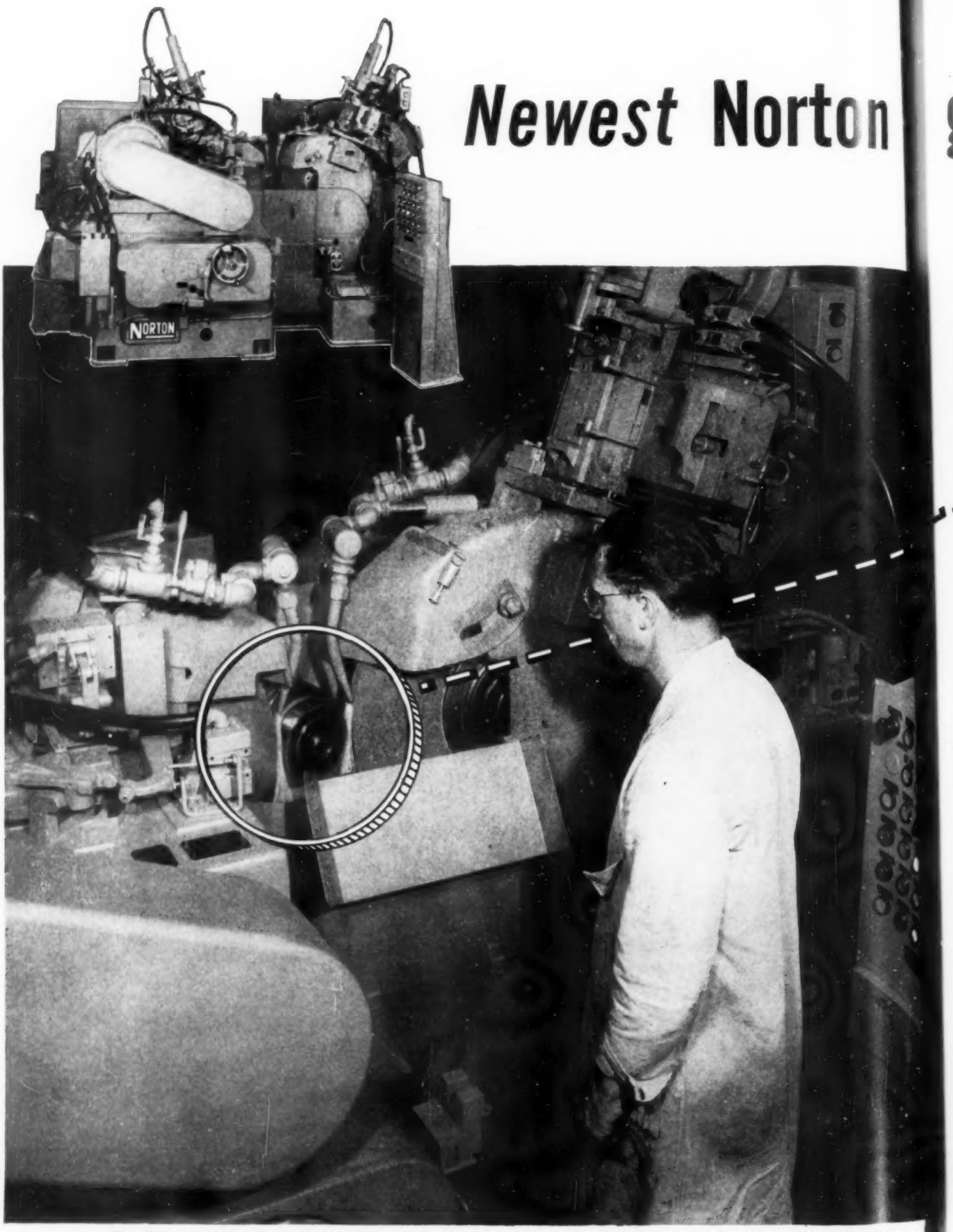

The "Touch of Gold" In Multiple Diameter Grinding. This Norton Type CMS-1 Semiautomatic Multi-Wheelslide Cylindrical Grinder is set up to grind two conical surfaces simultaneously in automatically controlled plunge grinds. The wheelslides, opposed here, may be positioned in-line if the job requires.

grinder for multiple diameters

The Type CMS-1 Semiautomatic Multi-Wheelslide Grinder handles jobs impossible on ordinary multi-wheel machines

Here's a brand new Norton grinder with a special capacity for high production, low cost grinding of multiple diameter work.

The Type CMS-1 Semiautomatic Multi-Wheelslide Cylindrical Grinding Machine cuts production time and expense in a number of different ways. It grinds with top speed and accuracy. It reduces grinding wheel costs. Most importantly, it eliminates the need for separate grinds on separate machines.

Advanced Multi-Wheelslide Arrangement

During building, the Type CMS-1's sturdy, unitized wheelslides are positioned — opposed or in line — for specific job requirements. In use, slight angular or lateral adjustments may be made when setting-up. Each wheelslide mounts one or more 30" grinding wheels, with the type of work-holding equipment depending on the job. Slides operate in unison during production, but may be individually controlled for set up.

Other Outstanding Features

- Central, one-lever control of the automatic grinding cycle — plus automatic, electrically timed termination of the cycle — for greatly simplified operation.
- Two-rate automatic feed assures ideal conditions for rapid stock removal, with highest accuracy and finish.
- Convenient wheel feed hand wheels have "click-count" indexing, permitting feed adjustments in increments of "tenths." This simplifies size control in setting-up and in initial operation.
- Individual push-button-operated jogging control of wheelslides aid production by simplifying size control.
- Automatic wheel guard type truing devices operate consistently at predetermined speed and feed. Control of the amount of abrasive removed is close and uniform, with compensation of wheelslide setting for wheel diameter reduction. Results are most efficient, effortless truing, with reduced wheel cost per piece ground.

Get All The Facts

on the new Type CMS-1 grinder from your Norton Representative. Learn how you can improve your competitive position by replacing two or more old grinders with this ultra-modern machine. Or write direct to us for the whole story. And remember: only Norton offers you such long experience in both grinding machines and wheels to bring you the "Touch of Gold" that helps you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Massachusetts.

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Making better products... to make your products better

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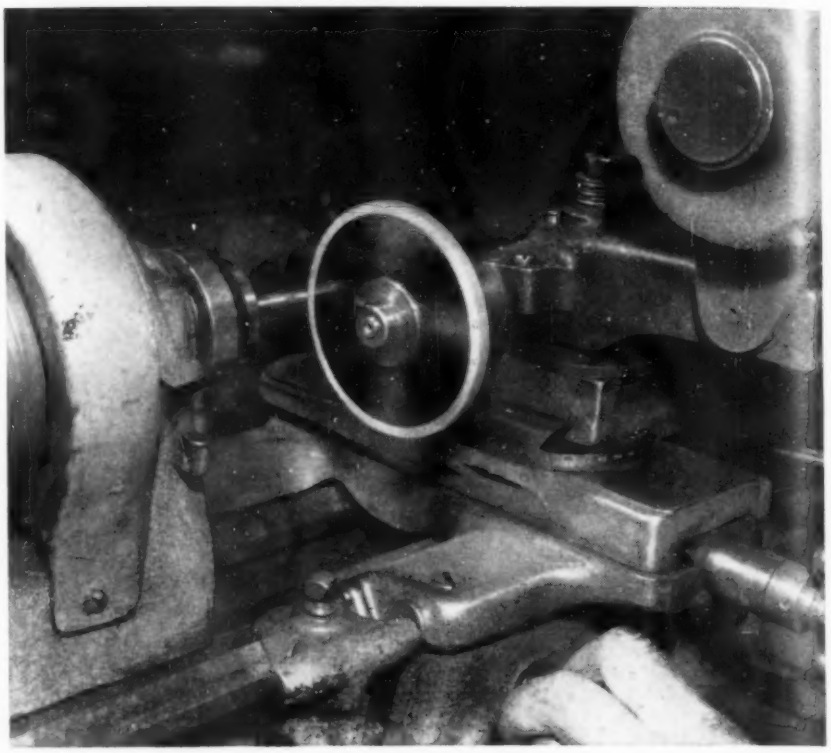
HOW TO BUY DIAMOND WHEELS

FOR FASTER, COOLER CUTTING

"More Use per Dollar"



Insist on diamond wheels specially bonded to resist loading or glazing . . . and designed in the proper size and shape to best meet your requirements. High cutting efficiency on carbide tipped tools, for fast production speeds, require the kind of precision grinding possible only with the diamond wheel.

Make certain the wheel you buy is *bonded* to permit cool, free cutting with light pressure, thus eliminating the danger of damage to heat-sensitive carbide, carbide tips and carbide inserts . . . Consider, too, the grit size that will give you the finish you want . . . and assure long, dependable wheel life. Be sure the wheel is designed for *your specific* internal, surface or cylindrical grinding operations.

Specify, by name, the diamond wheels engineered to give you these advantages . . . specify Manhattan Diamond Wheels.

MANHATTAN DIAMOND WHEELS

For surface, cylindrical or internal grinding operations, Manhattan Diamond Wheels give you faster, cooler cutting action . . . higher wheel efficiency and longer life on the toughest job. Manhattan Diamond Wheels are resinoid bonded for tungsten carbide grinding . . . metal bonded for grinding glass, quartz and ceramics. They will not load or glaze, and require no dressing for either wet or dry grinding operations. Manhattan Diamond Wheels are made in a variety of surface-contact shapes . . . in the diamond concentration and grit size to meet your exacting requirements.

When you specify Manhattan Diamond Wheels, you are buying "More Use per Dollar". Try them . . . write to DIAMOND WHEEL DEPARTMENT.

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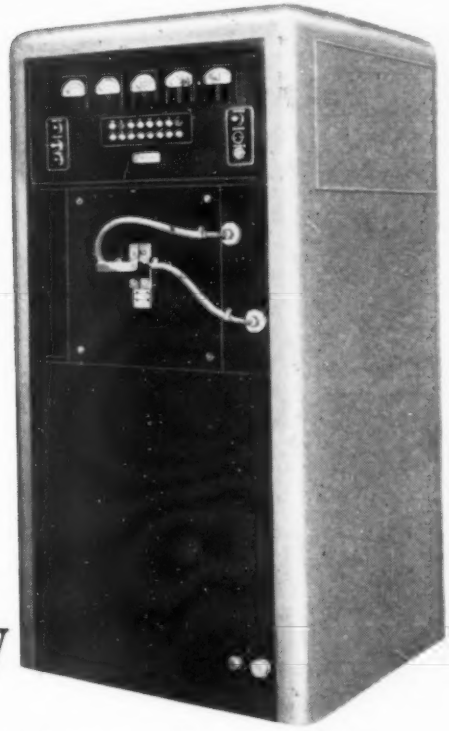
To help improve induction heating applications, Lindberg engineers have spent two years developing equipment for M-G set frequencies of 1 kc., 3 kc. and 10 kc. This equipment is now available to you.

This development has also produced many advanced design features that are incorporated in control and heating stations used in connection with motor generator equipment.

Generators are available in power outputs from 30 kw. to 1250 kw.

Lindberg engineers are now equipped to solve your metal heating problems using optimum frequencies for specific applications from 60 cycles upwards. For information consult your nearest Lindberg field office or write for Bulletin No. 1460.



The High Frequency Division of Lindberg Engineering Company announces a complete line of MOTOR GENERATOR EQUIPMENT for all Induction Heating Applications

HIGH FREQUENCY DIVISION
Lindberg Engineering Company
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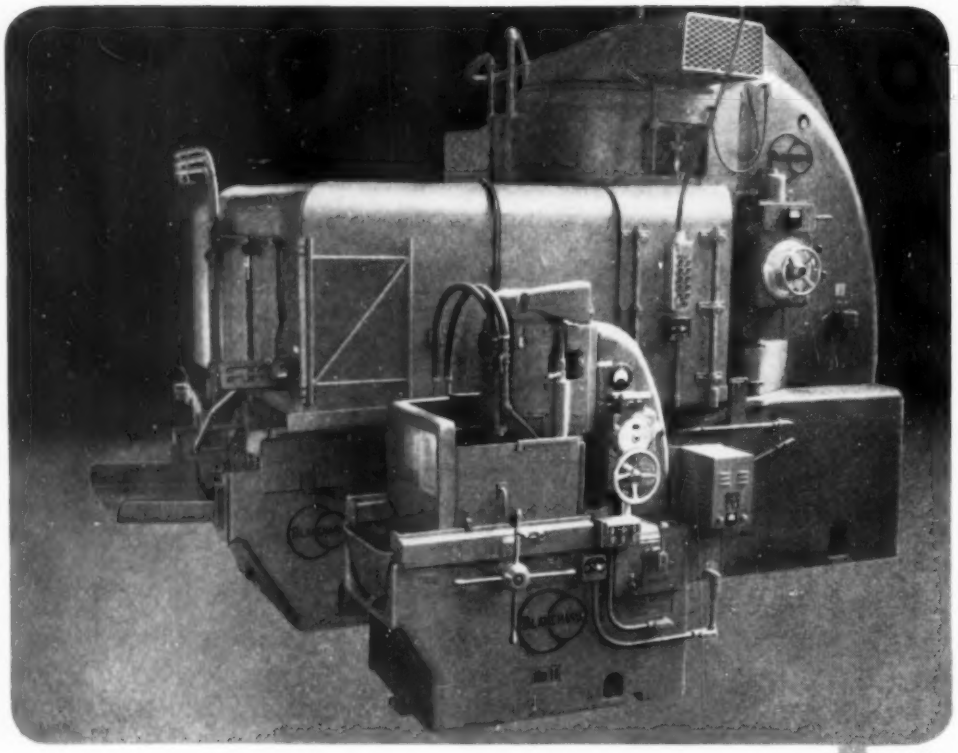
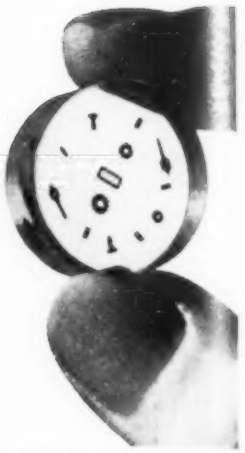
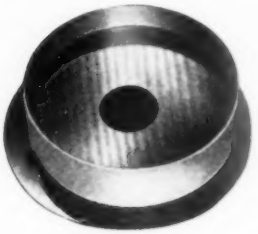


V-488



Tiny watch gears, pinions and ruby bearings — flat and parallel — to a dimension tolerance of .0002″.



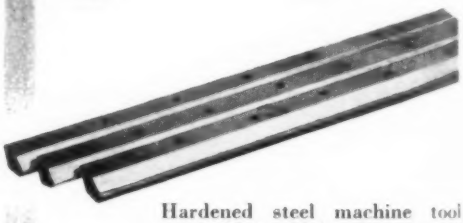
To 3 micro-inches and flat within *one* light band.

Please give us a chance!

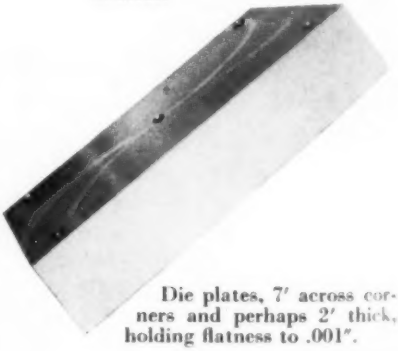
We *know* we can do *your* flat surface jobs. We've done them all — tiny watch parts . . . steel plates 7 feet across corners . . . copper and ceramics . . . *perfectly*. Just give us the correct wheel . . . (Blanchard wheels are preferable).

Blanchards regularly grind surfaces flat to within 2 to 4 light bands, parallel to less than .0001″, with dimension tolerance of .0002″ and surface finish to better than 3 micro-inches.

Honest, we Blanchards (15 models) work fast and inexpensively — whether the job requires precision grinding or rapid removal of stock. Give us a chance to prove we're the best investment you ever made.



Hardened steel machine tool ways, 2½″ x 3½″ x 50″, ground on 6 sides, flat within .001″ with surface finish of 5 micro-inches — *5 times faster than other methods!*



Die plates, 7′ across corners and perhaps 2′ thick, holding flatness to .001″.

Send for free copies of "Work Done on the Blanchard" (fourth edition), and "The Art of Blanchard Surface Grinding".

PUT IT ON THE BLANCHARD

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Living up to a standard for comparison isn't easy. That's why Crucible lavishes special care on the manufacture of REX® high speed steels... to keep REX the *standard* wherever high speed steels are used—as it has been for over half a century.

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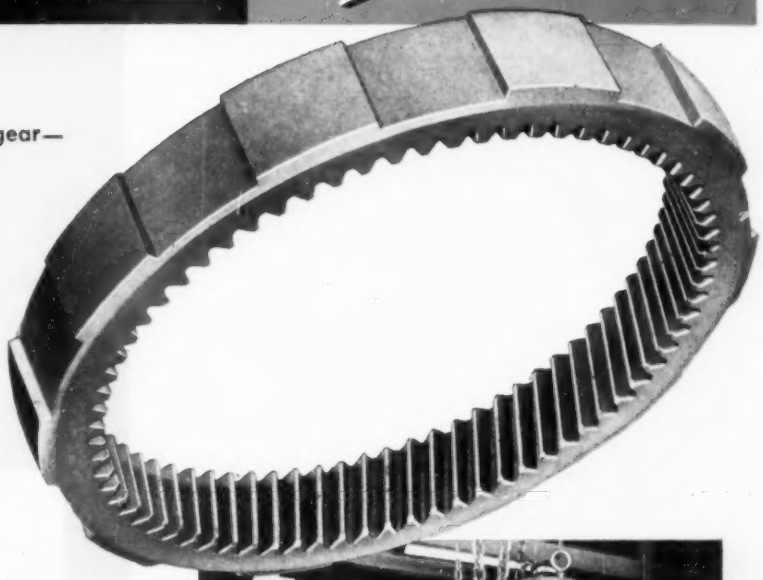
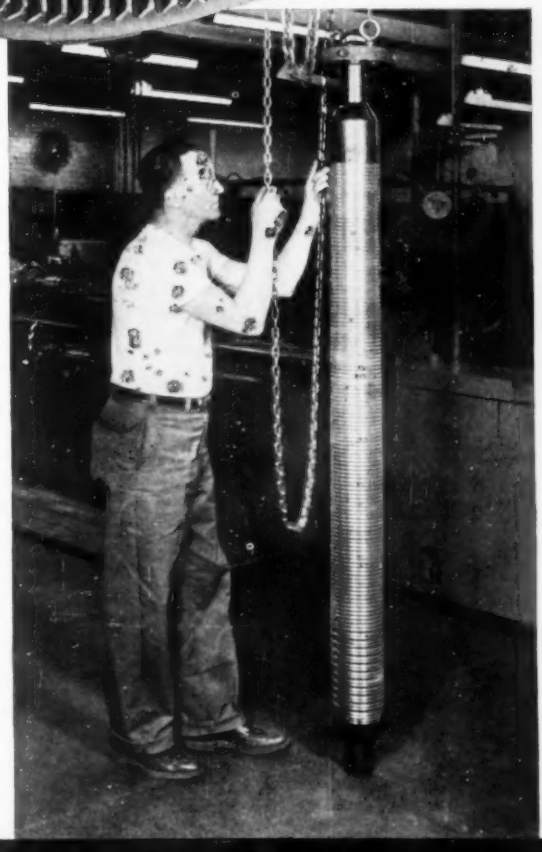


This is a 73 tooth automatic transmission gear—5.5853 P.D., 14 pitch, 20° pressure angle.

It is broached in just one pass. A single shaving operation completes it.

All critical dimensions including lead and concentricity are held to extremely close tolerances.

Broaching time	25 Seconds, **floor to floor**
Shaving time	40 Seconds, **floor to floor**
Total machining time	65 Seconds



The 7 foot Naloy Broach used also chamfers the gear tooth edges as it cuts the teeth.

The constant and intimate contact Red Ring engineers have with advanced gear practice gives them a very real advantage in the design and production of gear tooth broaches.

Write **for specific suggestions on your broaching operations.**

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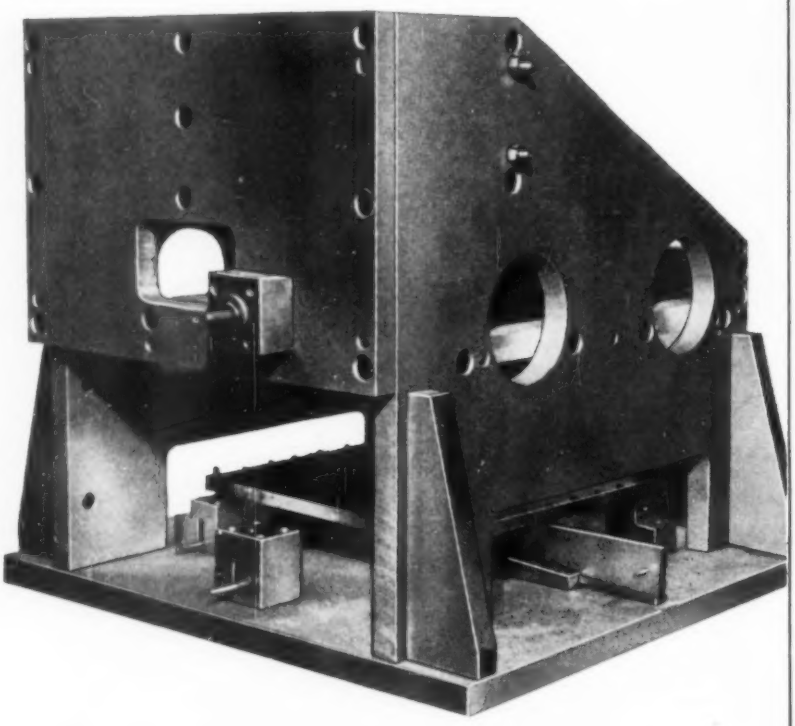

by
J. H. Matheny
co-owner
B & M
Engineering Co.
Burbank, Calif.

Specifications called for a check fixture approximately 26" wide, 34" long and 28" high to be light weight and maintain a tolerance of ±.0005".

We specified Pioneer 921-T cast aluminum tooling material. Its positive stability and exceptional mechanical properties made it ideal to meet those requirements.

We specify Pioneer 921-T on other jobs too. One reason is its adaptability to welding without distortion or need of normalizing. This is important because welded structure can cut fabrication costs up to 40%.

Also, Pioneer 921-T is 66% lighter than steel, it has 24,000 lb. compressive strength, and it can be machined at speeds up to 6000 FPM.

The advantages of these and other 921-T features are why we have been specifying 921-T for more than 3 years on assembly jigs, spar cap mill fixtures, drill jigs, check fixtures and various other designs. We think Pioneer 921-T is a remarkable tooling material.

B & M Engineering Company serves industry nationwide in specialized tool and machine design, project design and production engineering. It operates plants in Los Angeles and Burbank, and is a member of both the Southern California and National Tool and Die Manufacturers Associations.

PIONEER
Formula 921-T
cast aluminum tooling plates and bars
for use in jigs, dies, fixtures and special machines.

Write for 921-T Catalog
shows complete range of applications, important mechanical properties, stock sizes and special cast sizes.

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designed especially for

BORING AND MILLING SMALL PIECES

for PRODUCTION WORK or ONE-PIECE JOBS

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The MODEL 2B-36

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latest addition to a famous line of Precision Boring and Milling Machines

Model shown is the
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24" vertical travel
36" horizontal travel
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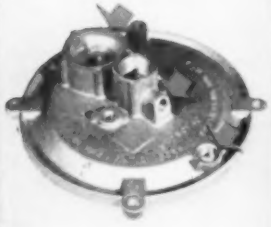
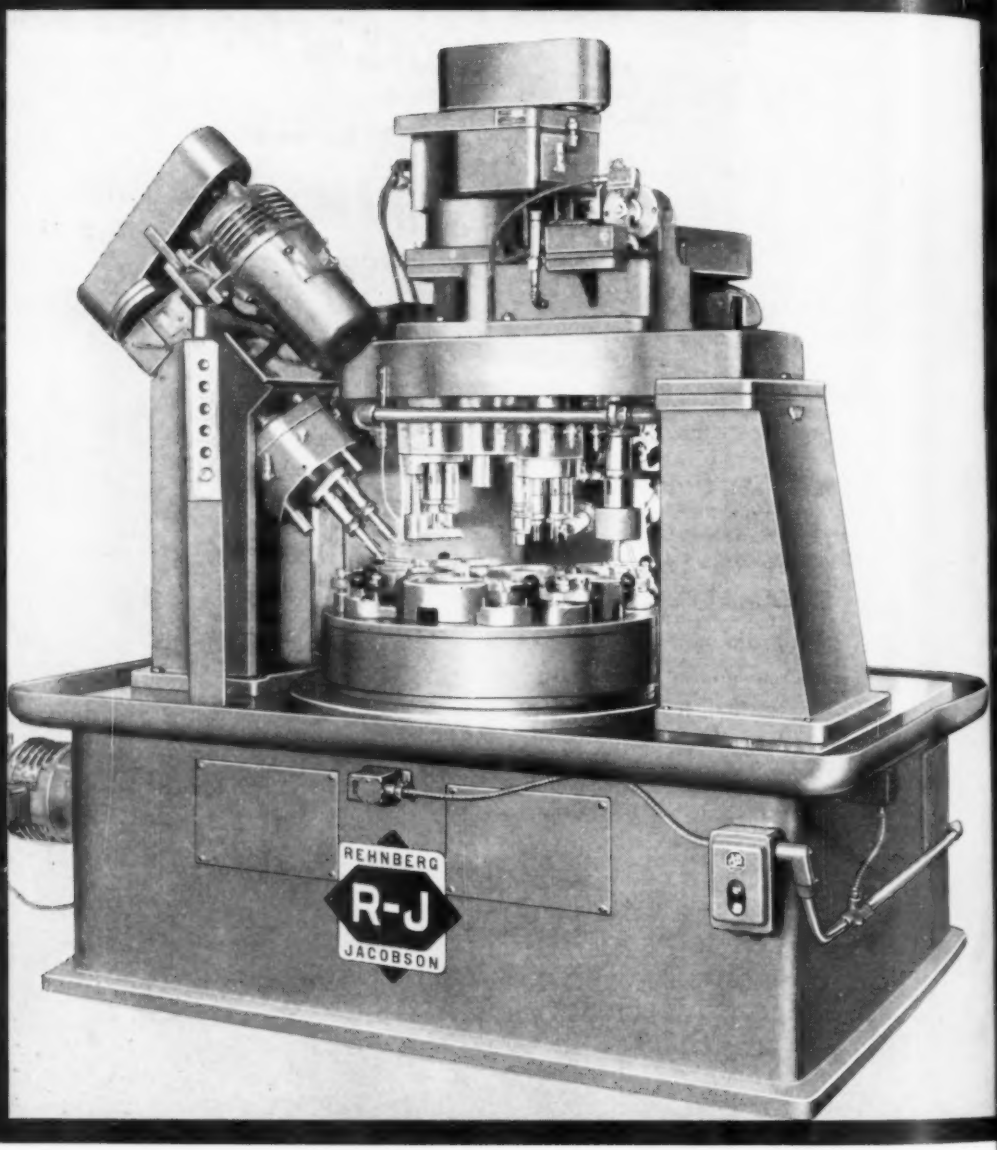
"Precision Holding" saves tooling problems on

Performs 15 operations at 75 to 80% less cost

Machining costs were reduced 75 to 80 per cent by this special four-station automatic index machine, designed to perform 15 operations on two sides of air brake end plates. On the smaller piece, five holes are drilled and tapped; one angular hole is reamed and its face is circular serrated; another angular surface is faced; and the interior of the housing is faced and reamed. Larger piece also machined is similar but with only one angular surface and the addition of a pipe thread.

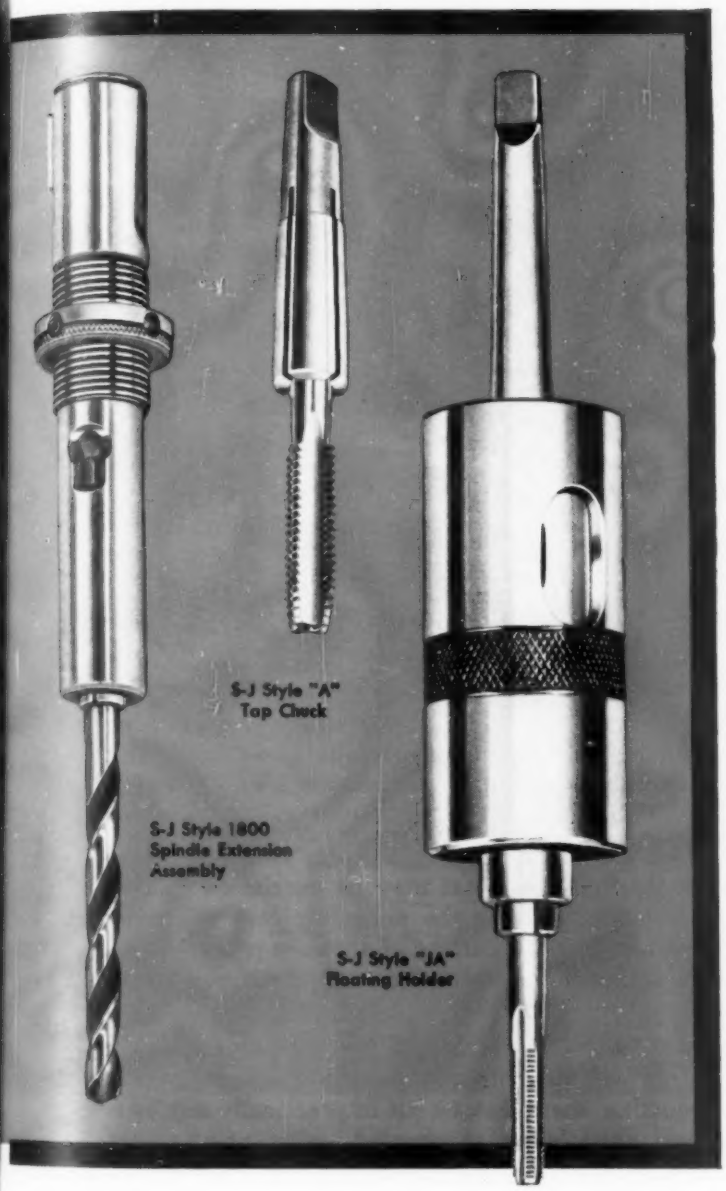




Rehnberg-Jacobson specifies Scully-Jones Spindle Extension Assemblies, Floating Holders, and Tap Chucks

Rehnberg-Jacobson Manufacturing Company, Rockford, Ill., designed this special four-station automatic index drilling, reaming, tapping, facing, and serrating machine for a large manufacturer of air brakes. Machine has one loading position and three working positions. Work is clamped manually in simple locating fixtures, which are changed easily to accommodate two sizes and different operations required on partially finished aluminum die castings. Scully-Jones Spindle Extension Assemblies, Floating Holders, and Tap Chucks were specified to simplify tooling changes, eliminate breakage, and maintain the accuracy built in the machine.

time and money, solves diversified spindle-type machine tools!



It pays to specify Scully-Jones "Precision Holding" to solve tooling problems and properly adapt cutting tools to the machine and the job. Here are three of more than 50 different "precision holding" tools that simplify operations, reduce downtime, and improve production.

The Style "JA" Floating Holder gives you extra protection against tool breakage and inaccuracies due to misalignment because there can be no binding or "dead spots" in the action of the collet. Its exclusive double gear spline drive principle assures unrestricted float, difficult or impossible to achieve with other holders on the market.

To convert multiple spindles and adapt tooling for a variety of operations, Scully-Jones Spindle Extension Assemblies are available in both small and large body diameters. These units accommodate tooling which requires a wide range of inside tapers and body lengths to extend or alter machine spindles. The Quick-Lock Nut permits fast, accurate adjustment in the spindles or pre-setting outside the machine. New "keyhole"-type drift slot accommodates both "keyhole"- and cam-type tool ejectors.

Style "A" Tap Chucks, with four-slot design, provide up to four times greater holding power on the tap shank, increase resistance to pull-out, and reduce tool breakage. Chuck closes evenly on all sides and along the length of the tap shank, assuring accurate operations.

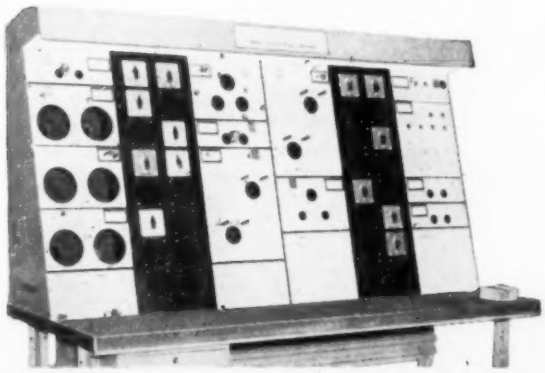
Call your Scully-Jones factory-trained representative or distributor, today.

SCULLY JONES

Scully-Jones and Company, 1915 So. Rockwell St., Chicago 8, Ill.

Scully-Jones "TOOLITROL" Boards and Gages

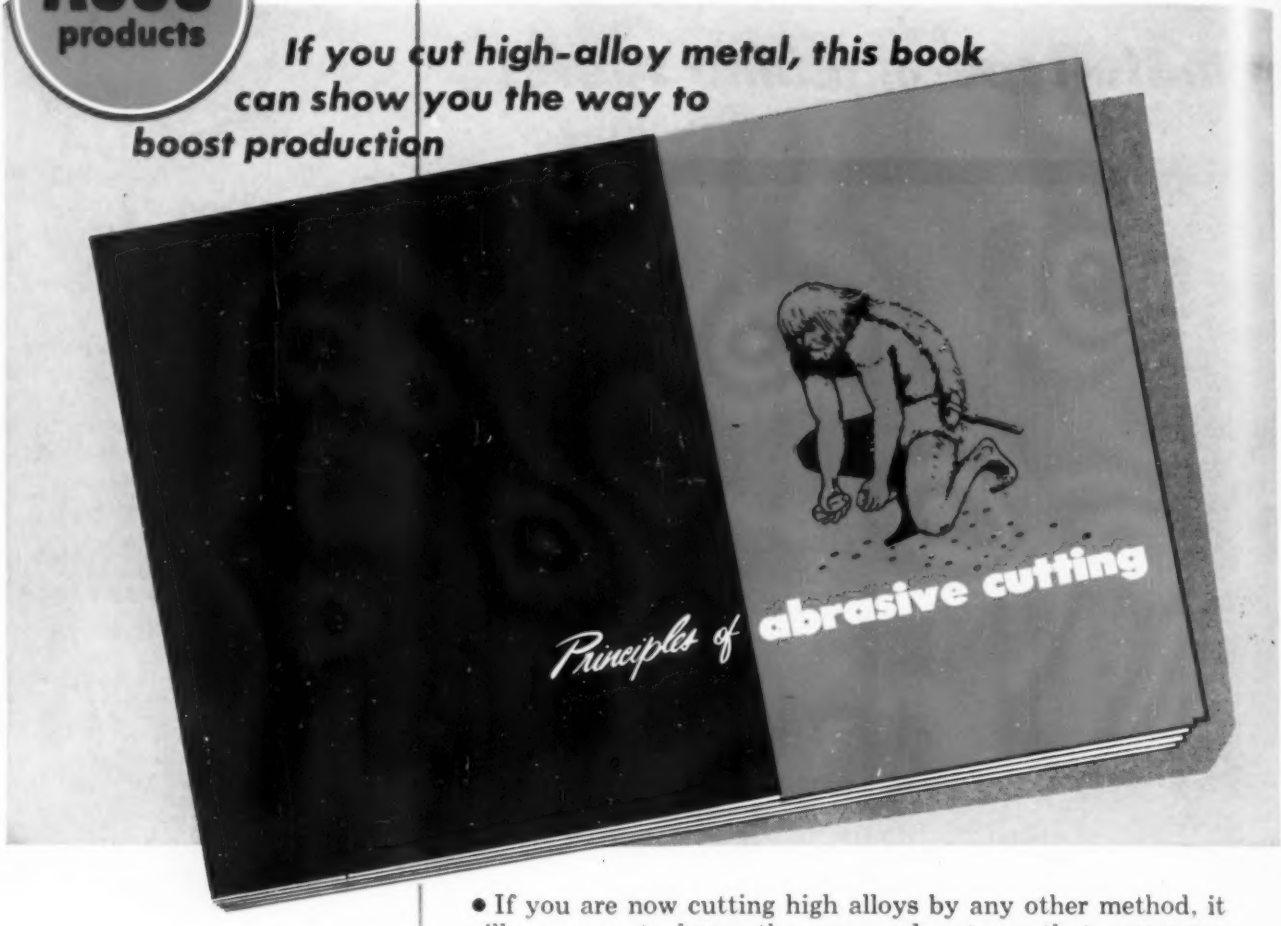
Reduce setup time, downtime, inspection time, and keep multiple-spindle machine tools operating at maximum capacity with Scully-Jones "Toolitrol" boards and gages. Scully-Jones engineers, with a complete line of holding and driving tools to choose from, can help you plan and design a completely integrated tool control method and solve at-the-machine problems of pre-setting, storing, and changing tools. For complete information, write for Bulletin No. 19-50.



ACCO products

Campbell Abrasive Cut-off Machines

If you cut high-alloy metal, this book can show you the way to boost production



CAMPBELL OFFERS WIDEST SELECTION OF ABRASIVE CUT-OFF MACHINES FOR EVERY NEED

Capacities—from 1" to 12" diam. solids

Hand-operated submerged cutting machines

Wet or dry machines for general shop requirements

Bar-cutting machines for continuous production

All-purpose wet abrasive horizontal cutting machines

Fully-automatic wet abrasive cutting machines

Hydraulically-operated. wet abrasive cutting machines

Rotary-oscillating-hydraulic wet abrasive cutting machines

• If you are now cutting high alloys by any other method, it will pay you to know the many advantages that CAMPBELL abrasive cutting can bring.

LOW COST FACTOR When cutting sections abrasively from bar lengths for forging, the metal may be purchased "unannealed." In some cases, saving the annealing cost will more than pay for cutting. Smooth cutting of abrasive process saves cost of smoothing operations. Accuracy of abrasive method reduces scrap loss.

HIGH QUALITY FACTOR High quality control standards are usually maintained by laboratory testing of specimen cuts. With abrasive cutting, metal can be cut in practically any condition—soft, hard, annealed or unannealed—with cut-off pieces ready for deep etching.

• Find out TODAY what the CAMPBELL methods can do for you. Testing procedure by CAMPBELL engineers will show conclusively whether abrasive cutting machines will save YOU money.

Write for **DH-301** *"Principles of Abrasive Cutting" today*

ACCO

TRADE MARK

Campbell Machine Division
AMERICAN CHAIN & CABLE

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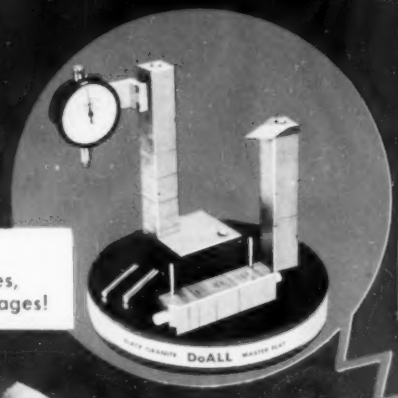
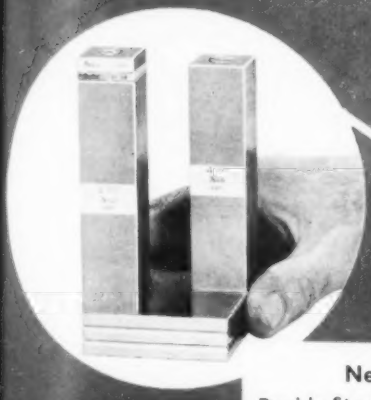
Better Value

NEW SQUARE BLOCK GAGING SYSTEM!



New—
Indicating Gages, Scribers and Pin Gages!

New—
Adjustable Tie Rods!



New—
Double Stack Base Blocks!

Greater Accuracy . . . Greater Usefulness
Faster, Easier Gage Assembly . . .

Accuracy of gage block calibration depends upon *surface finish!* New DoALL Square Blocks have the finest finish of any in the world—0.6 micro-inches R.M.S. or better! Calibration error is reduced to a new minimum for commercial gage blocks.

To preserve and make full use of this superior accuracy, DoALL has developed completely new and different accessories. The combination sets an entirely new standard for precision gaging.

DoALL

The DoALL Company
Des Plaines, Illinois

Turn the page for more factual details. ——→

EXCLUSIVE INDICATING GAGE ELIMINATES "FEEL".

In precision measurement in the range of 1/10000 inch, the human sense of "feel" fails. Now, DoALL offers universal dial indicator sets for use with any make of square blocks to eliminate human error.

MANUFACTURED BY DoALL in an entirely new, air conditioned and magnificently equipped gage laboratory. View shows lapping according to a DoALL-developed probability formula. Three-color interferometry is used at DoALL to calibrate Master blocks.

Make Millionths-Accurate Gages Quickly at Low Cost

With new ultra-accurate DoALL Square Blocks and new versatile accessories, you can make thousands of precision gages quickly at a fraction of the cost of special gages . . . use them in the inspection department, in the toolroom *and in the shop* . . . get greater dimensional accuracy, prevent costly errors. Why be satisfied with less? The cost per gage is low—blocks incur very little wear when used with DoALL Accessories.

Ask for a Free Demonstration

See a DoALL Square Block Gaging demonstration at your own plant, free of charge and without obligation. Compare them, try them, judge for yourself. Call your local DoALL Store or write: The DoALL Company, Des Plaines, Illinois.

Ask for Literature describing DoALL Square Blocks and Accessory Sets.

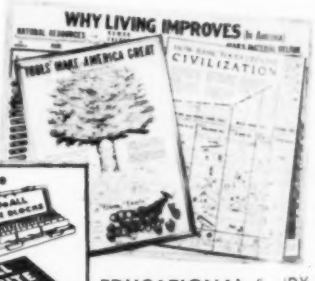
A COMPLETE LINE OF
DIMENSIONAL QUALITY CONTROL EQUIPMENT

Square Gage blocks and Accessories • Rectangular Gage Blocks and Micro-Step Gaging System • Mechanical and Electric Comparators • Black Granite Surface Plates, Straight Edges, Angle Plates, Toolmakers' Flats, Parallels, Magnetic Chuck Platforms • Optical Comparators and Charts and Fixtures • Stereomicroscopes • Brinell Microscope • Toolmakers' Microscopes • Sine Bars and Plates • Optical Flats • Monochromatic Lights • Surface Roughness Scales • Mobile Inspection Units • Micrometers and Calipers • Plug and Ring Gages . . . and many other items!

DoALL

Friendly DoAll Stores . . . (in 37 cities)

'ersonalized Service . . . Complete Stocks . . . Local Delivery



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Lower quantity ces

"Operations Kingsbury" drills tubular valve in 5 seconds

A large manufacturer sent us a small piece of steel which had been partially completed on a screw machine. He said: "Drill five holes and remove the burrs . . . ." That's a job for any drill press!

But when he said: "I want over 700 pieces an hour gross . . . "

THAT'S A JOB FOR A KINGSBURY.

Here's the machine. Four horizontal units and one vertical unit are mounted on a 72-inch diameter semi-circular base. A 20-inch table with four work-holding fixtures indexes through four stations.

Work is performed at three stations, as follows: *Station 1:* Unit 1-H with two-spindle offset auxiliary head, drills two holes from one direction, while Unit 1-Rear with a single spindle auxiliary offset head, mounted on the other side of the base, drills the opposing hole.

Station 2: Units 2-HTL and 2-HTR drill opposing holes.

Station 3: Unit 3-V, with special burring tool, removes the burrs from five holes.

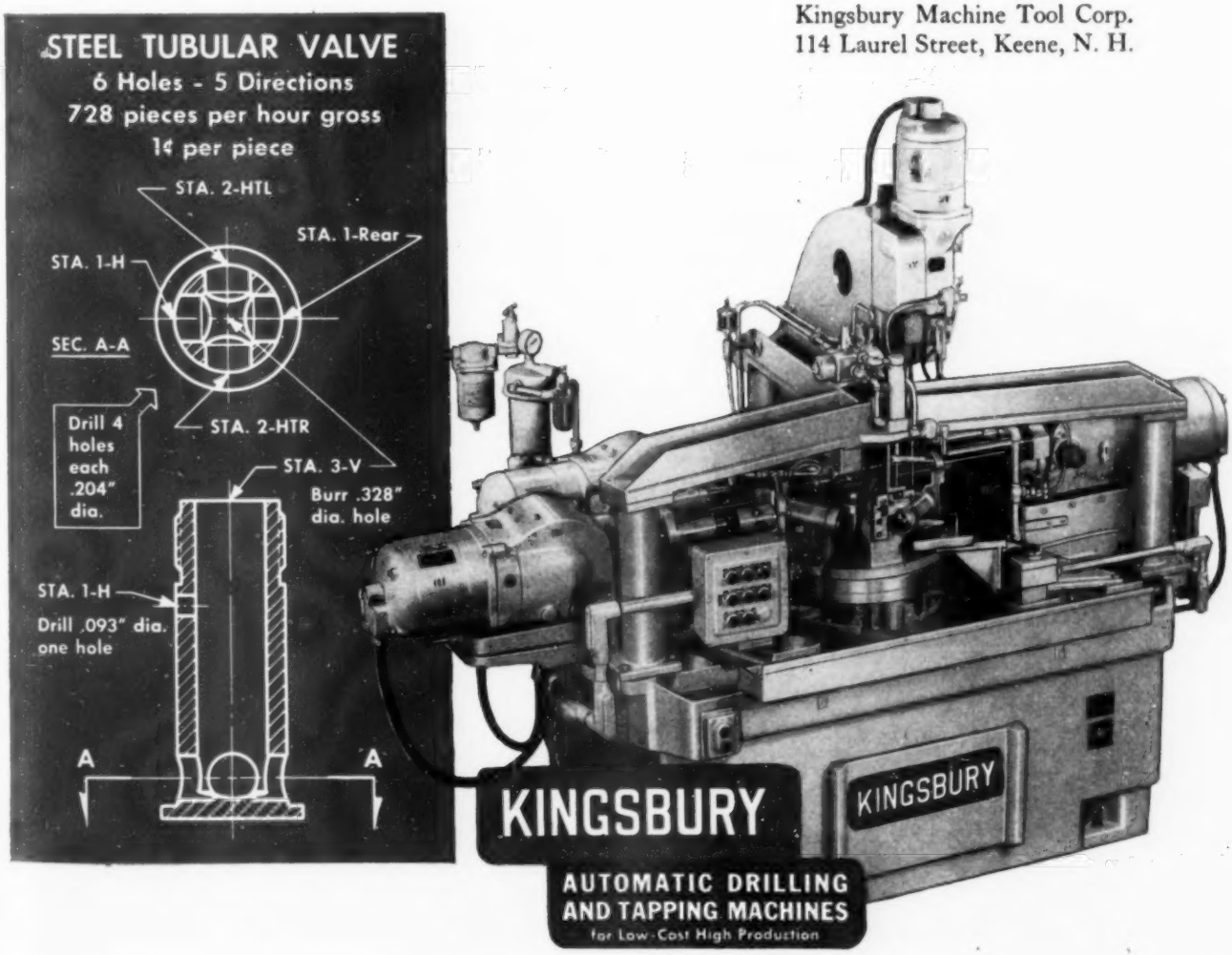
At Station 4 the work-holding fixture automatically releases the piece and ejects it through the bottom of the fixture. The operator then reloads. The piece is clamped automatically in the fixture with the flange at bottom.

This job, while relatively simple, presented problems. To produce upwards of 700 pieces per hour, more than one drilling operation had to be performed during a working interval. Notice also that, beyond the full diameter of each of the four .204" dia. holes, the bottom of the larger central hole is "end-milled" by the .204" drill. This necessitated drill bushings located on the fixture *as close to the work as possible.* In fact, all three drills are guided by bushings to insure accuracy.

An output of 728 pieces per hour is approximately one piece delivered every 5 seconds. We provide maximum time for *loading* by *unclamping and unloading* the fixture automatically at the end of the work cycle.

When you buy a Kingsbury you acquire a custom-built machine, complete in *every* detail!

Kingsbury Machine Tool Corp.
114 Laurel Street, Keene, N. H.



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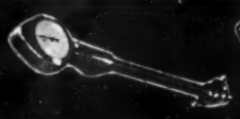
*30 stock answers to your gaging problems . . .

SNAP GAGES
Adjustable, for O.D., I. D., shoulders, grooves. 0" to 6" range with 2 models.

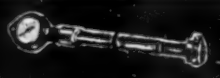
GROOVE LOCATION GAGE
Checks from face to top or bottom of groove, and deep holes or slots.

GROOVE GAGES
For "0" ring and snap ring grooves. 1/4" bore to 5". Adaptable for special applications.

BORE GAGES
For bores 1/8" to 12" dia. Two point setting with equalizers.



DEEP HOLE GAGES
For bores up to 20 feet in length. Prices on application.



TEST INDICATORS
Exclusive features with .001 or .0001 accuracy.

COMPARASCOPE
A precision instrument for checking surface finishes. West Coast Distributor for Hemco Gages

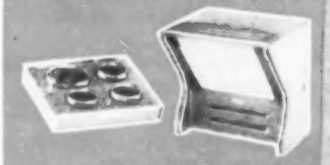
The Reli-a-chek Gaging Group is made up of instruments that are foremost in their field, in both quality and price.

Further, Reliant's balanced line offers a single source for most gaging requirements.

All of these precision instruments have unusual and desirable features, and some unique in design and performance.

* There are many more, and some "special" ones, too.

THREAD AND GEAR WIRES
Finest quality measuring wires.



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Wide choice of capacities, with high level of visibility.

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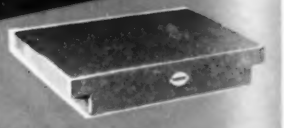
Solid square in "A" accuracy. Rectangular in "A" or "B". Round micro-gages in "B".



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Black granite, honed surface to 50 millionths accuracy.

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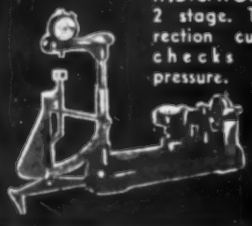
5" or 10" sizes with projecting cylinders.

PLUG AND RING GAGES
Finest precision chrome plated gages.
West Coast Distributor for Hemco Gages

ELECTRIC COMPARATORS
English or metric graduations.
4 gaging ranges.

TEST SETS
Magnetic base or T-slot base models.

INDICATOR TESTER
2 stage. Takes correction curve and checks measuring pressure.



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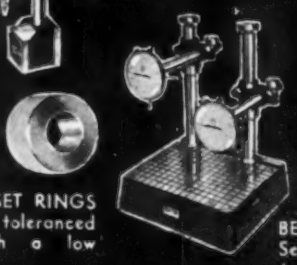
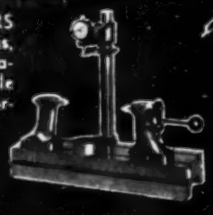
Special - toleranced rings with a low price.



BENCH CENTERS
Inspect lengths, heights and diameters. Reversible centers. Accessories available.



VERNIER CALIPERS
Hardened tool steel with extended verniers. 6", 12", 20", 24" and 36" models.

BENCH COMPARATORS
Several types available. 1 or 2 indicators.

HEIGHT GAGES
12", 18", 24" and 36" models. Extended verniers, carbide scribers, zero adjustment to surface.

TOOLING BALLS
4 shank lengths. Accessories for use with sight levels, transits, auto-collimators.

Reliant

RELIANT GAGE & SUPPLY CO.
4947 FIRESTONE BOULEVARD
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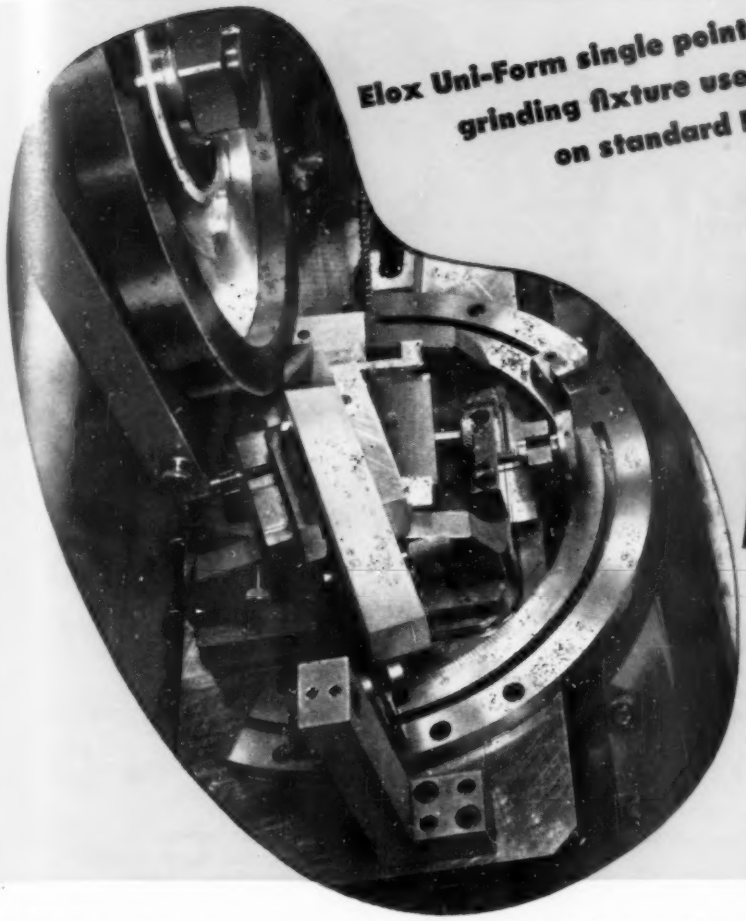
Gages



Elox Uni-Form single point grinding fixture used on standard EDM grinder.

Left: Elox ground single point tool. Right: Standard ground tool. Note smooth even cutting edge and radius of Elox ground tool as compared to standard ground tool. (Unretouched photo).

grind 2 faces and radius on 1/2" x 1" carbide insert in 3-1/2 minutes automatically . . . repetitively . . . without variation . . . without heat checks . . . without manual assistance!

Elox Electrical Discharge Machining of single point tools is an electronically controlled push button operation. Variable human elements are completely eliminated, guaranteeing every tool sharpened identical as to finish, radius. Grinding is done with a brass wheel to any pre-determined specifications. Every tool repetitively uniform!

Advantages of Elox Uni-Form Tool Grinding:

- **Permits use of standard blanks**
- **Every tool is identical as to radius, finish**
- **Increased tool life**
- **More regrinds per tool**
- **Eliminates diamond wheels**
- **Carbide and tool shank are ground simultaneously**
- **Averages 40% labor savings**

elox* *corporation of michigan*

737 N. Rochester Road
Clawson, Michigan

DEMONSTRATION CENTERS:
Plant—Clawson, Mich.
45 Broad Ave., Palisades Park, N.J.
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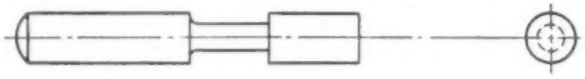
See Elox Uni-Form Single Point Tool Fixture in operation at Elox Demonstration Centers.

*T.M. Reg.

Swaging Success Stories

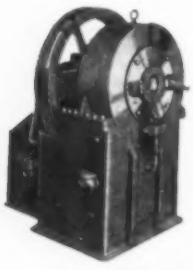
Close Tolerances... without Machining

This finished piece used to be made on an automatic screw machine with the long, narrow diameter section turned to .100 ±.003 and a necessary sharp shoulder.



Torrington's swaging experts suggested starting with this simple screw machine blank (to retain the required shoulder).

Result after one rotary swage—an improved finished piece, to a tolerance of ±.001.



THE TORRINGTON COMPANY
Swager Department
444 North Street, Torrington, Conn.
Makers of Torrington Needle Bearings

Why not write for our informative booklet on swaging that includes complete descriptions of Torrington Rotary Swagers. It may show you how you can achieve a "swaging success story" in your own plant.

See what savings you can make by swaging

1. Saving in material—swaging uses nearly all the metal.

2. Saving in time—swaging is fast.

3. Saving in labor—unskilled labor can run a swager.

4. Saving in machining—swaging produces finishes accurate to ±.001.

5. Saving in finishing operations—swaging produces high finish, better hardness and resiliency.

TORRINGTON ROTARY SWAGING MACHINES

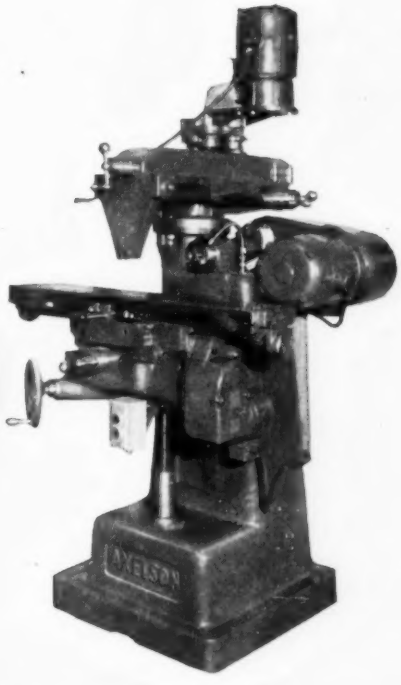
FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A-12-62

there's a NEW one to look at . . .

Whether you're an old timer or relatively new in machine shop matters, don't overlook Axelson if you're thinking about a milling machine.

Probably you know about Axelson lathes. We've been building them for over 40 years, and have earned a proud reputation with them. Now we offer a milling machine engineered and built to the same high standards of strength and precision.

If you're in the market for a milling machine, it will pay you to look at Axelson. We'll be happy to send descriptive bulletins that tell the whole story. Just ask us.



AXELSON

MILLING MACHINES

make man hours mean more

Producers of the World famous Axelson Lathe

AXELSON MANUFACTURING COMPANY

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to cut machining costs

machine faster with

Continuous Broaching

■ Higher machining production than ever achieved by any other method has been made possible in many cases through the use of the Footburt Continuous Surface Broaching Machines. In most cases, production is limited only by the speed at which parts can be loaded into the self-clamping fixture. Unloading is automatic. If you have a problem of high production on small parts, send blueprints and hourly requirements.

THE FOOTE-BURT COMPANY
Cleveland 8, Ohio
Detroit Office: General Motors Building

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Useful facts gathered during Oakite's years of experience in barrel finishing are packed like #12 stones in this 10-page booklet covering such subjects as:

PRECLEANING—Good tank cleaning; Good barrel cleaning; Good rinsing saves money.

CUTTING DOWN, DEBURRING—Good solutions; Abrasive media, water and work ratios, etc.

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FREE... For your copy of *"May I put my head in your finishing barrel?"* just write or mail the coupon.

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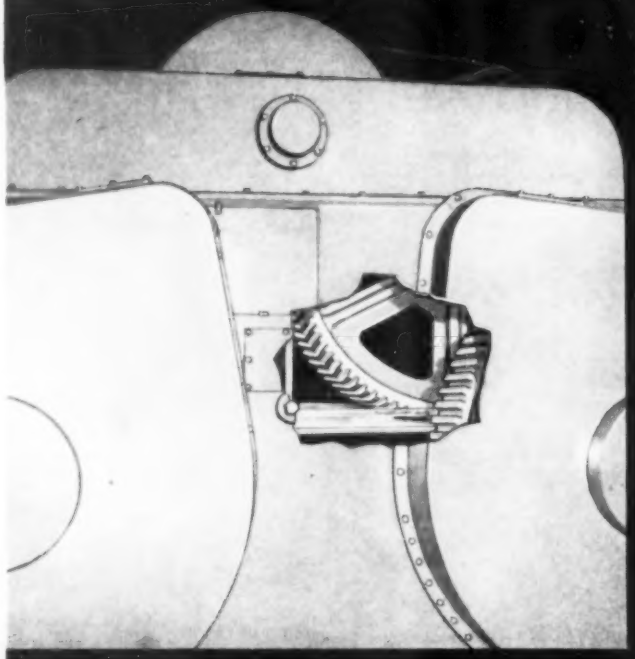
These are the features **that make –Verson– presses your best buy**

DRIVE GEARS

operate in oil bath to assure long life and smooth, efficient operation with

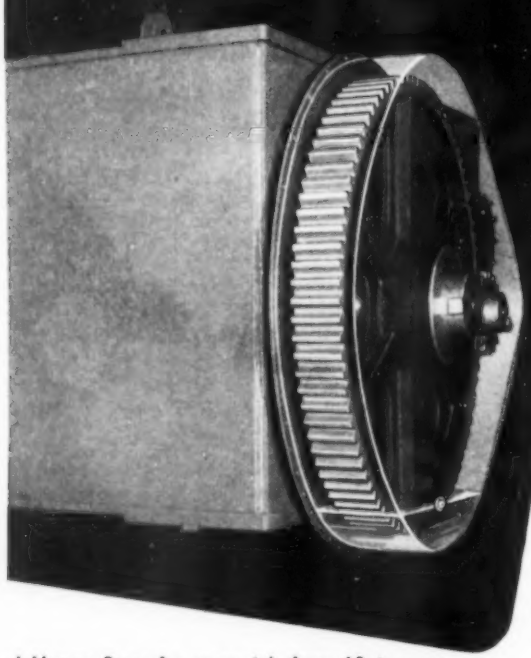
Verson

PRESSES



Cutaway showing how herringbone intermediate gears operate in oil bath within the crown.

Cutaway showing Verson main gears and the oil bath in which they operate.



As the cutaway views at the left show, drive gears in Verson presses are fully enclosed and operate in an oil bath.

This is the positive way of insuring effective lubrication. Each tooth of the gear passes through the oil on each revolution to pick up its protective film of oil. For the press user, it is the kind of protection that means smooth, efficient operation throughout a long, trouble-free life.

Gears operating in oil is just one of the many advantages built into Verson Presses to give the user more and better stampings at lower overall cost. Whether you require a single press or an entire stamping plant complete with tooling, be sure to get the whole story of what Verson quality can mean to you.

For specific recommendations, send an outline of your requirements.

Catalogs are available describing the Verson lines. Please write for yours, mentioning the types of presses in which you are interested.

A Verson Press for every job from 60 tons up.

Verson

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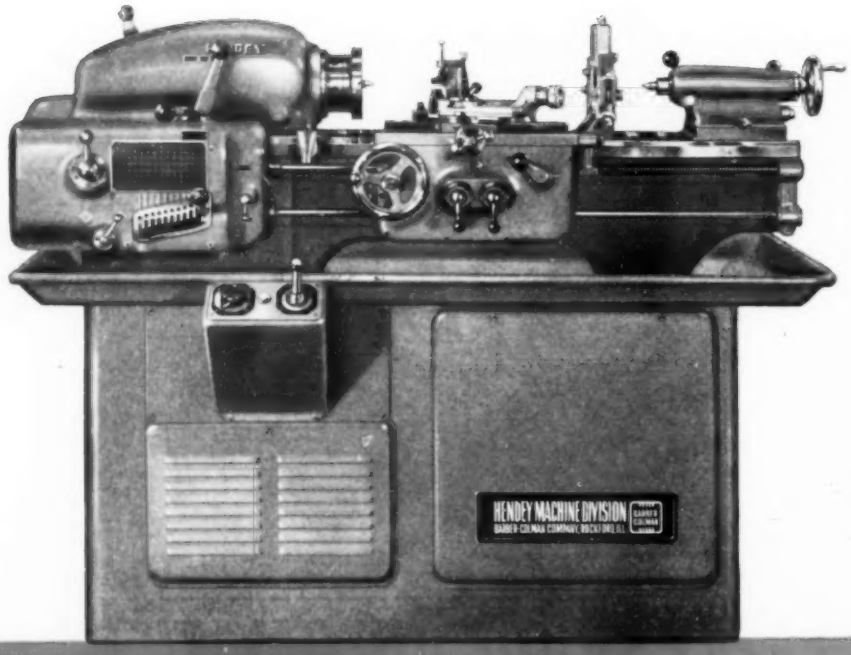

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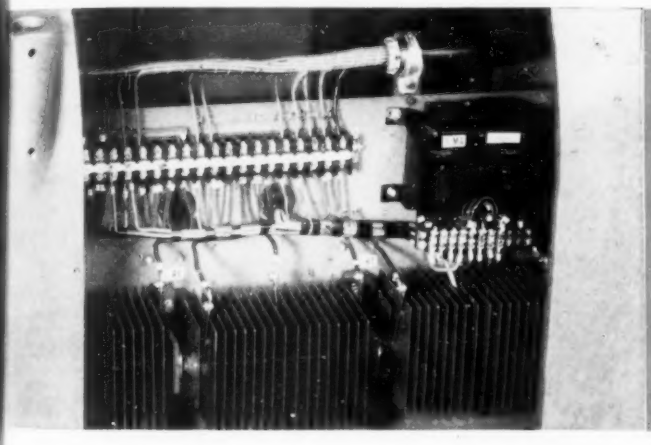
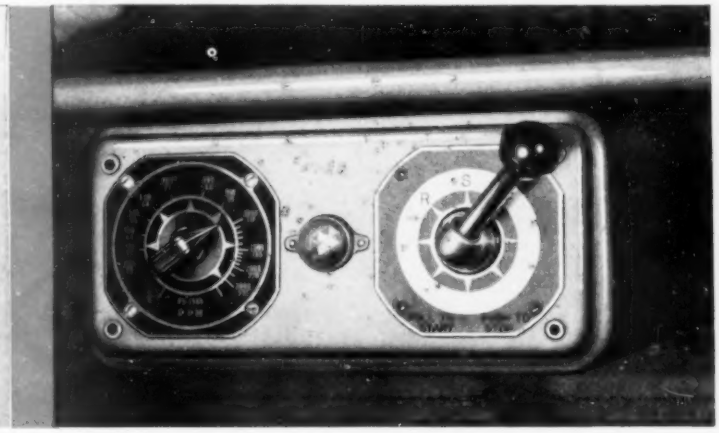
Section of Magnetic Amplifier Unit



Speed Control Knob and Dial



other features

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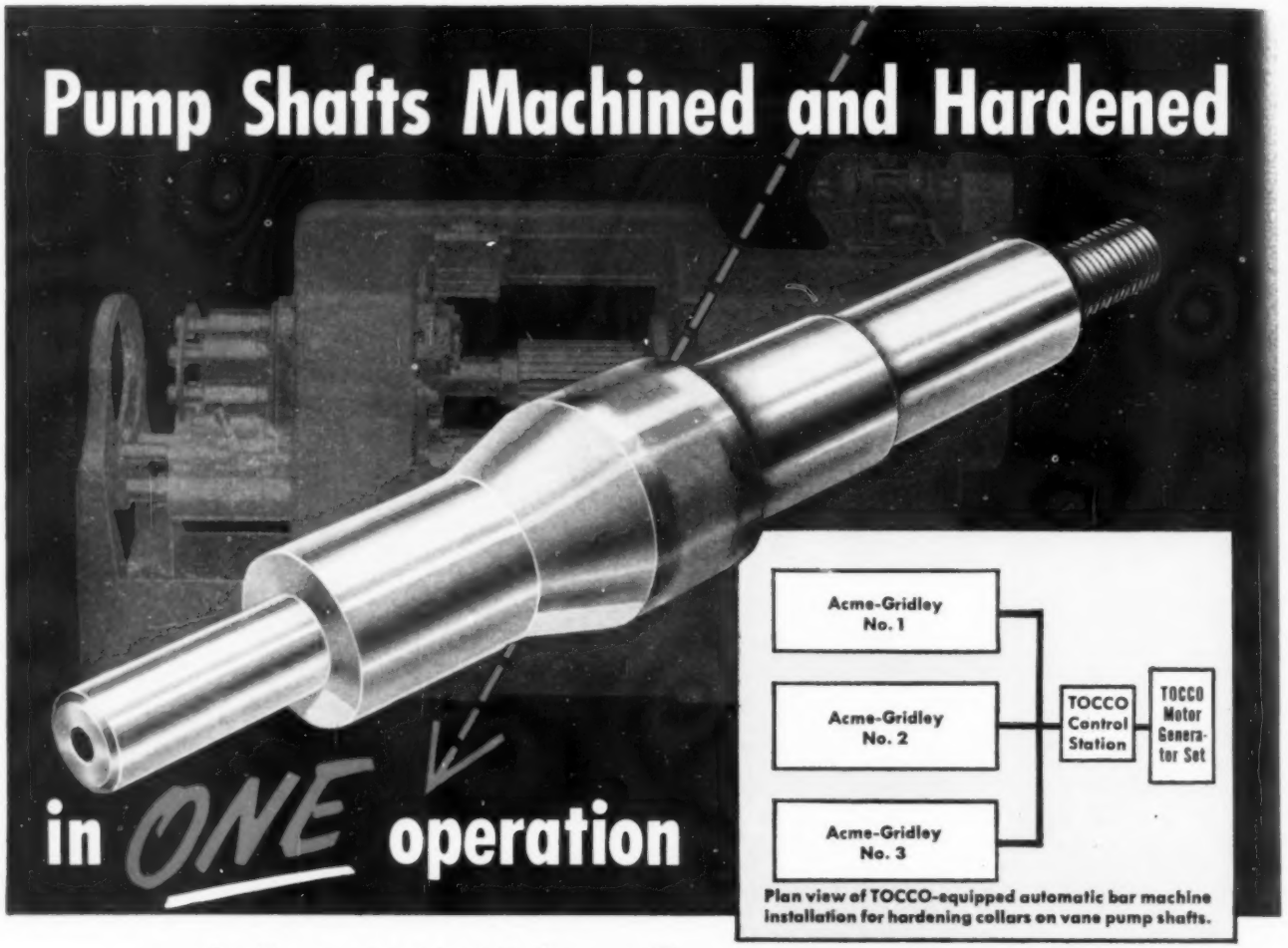

Plan view of TOCCO-equipped automatic bar machine installation for hardening collars on vane pump shafts.

with TOCCO* Induction Heating

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The Tool Engineer

We Got What It Takes!

This place we call the United States of America has developed to levels never before achieved by any other nation. All of this has been accomplished in an infinitesimal space of time when compared with the history of civilization. In contrast, others have just coasted along over the centuries—generally unwilling, but rarely unable to do much else. Here we are with the highest standard of living ever known to man because we know better than anyone else how to produce more goods for more people at less cost.

We annually consume over half the world's production of oil and steel. We buy almost 80 percent of its automobiles, radios, refrigerators and other "necessities" of living which are luxuries elsewhere. This market is keenly observed by the rest of the world which finds it difficult to even maintain its own standard of living while ours continues upward.

There isn't an American manufacturing executive alive who doesn't take delight in getting the jump on one of his competitors. He may use a new model, retaliate with a lower price or overwhelm with a new product. Even more important, he may develop a new angle in production, a new process, a new method. In these he takes special delight. This spirit of achievement is important because it depicts some of his basic characteristics—undaunted optimism steeped in restless dynamic energy, completely free from traditional fears.

H. B. Osborn Jr.

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for rounding • chamfering • pointing • burring

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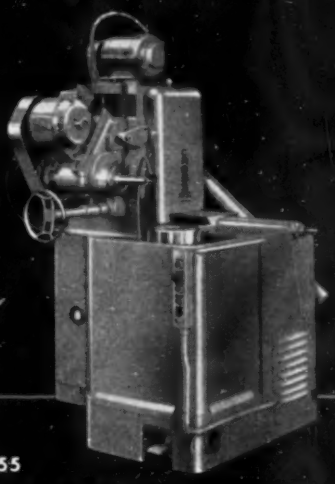
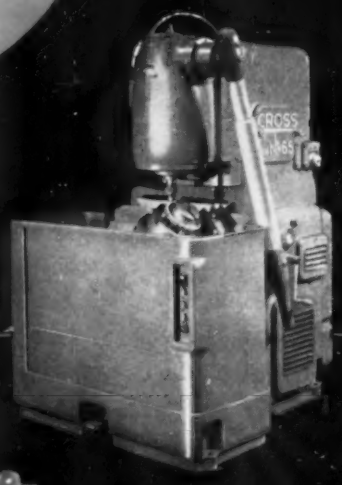


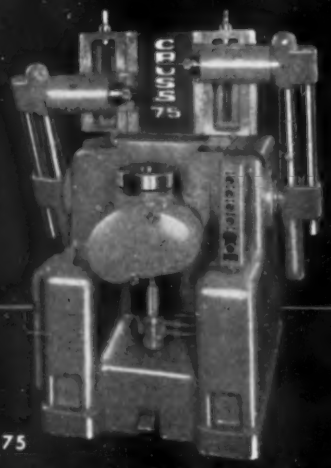
NO. 55

For rounding, pointing, chamfering or burring external and internal—
spur gears • helical gears
clutches • splines
Typical production—rounding or pointing 8 pitch 30 tooth gears—55 net hourly.



NO. 65

For pointing or chamfering external and internal—
clutches • spur gears
bevel gears • splines
Typical production—pointing 10 pitch 30 tooth gears—100 net hourly.



NO. 75

For burring or chamfering both ends at the same time—
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hypoid pinions
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★ Flexibility for handling a wide variety of gears.
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★ Short setup time (as little as 15 minutes) for changing from one gear to another.
★ Simple, inexpensive tooling.
★ Push button controlled automatic cycle.
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Established 1898

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Special MACHINE TOOLS

Fig. 1. New machines are debugged and proved before being installed on the production floor. Plant engineering, manufacturing and tooling join in development which is isolated from production schedules.

Machine Development Program

conserves production time

By V. M. Colton
General Supervisor
Machined Parts
Planning and Design
Douglas Aircraft Co., Inc.,
El Segundo, Calif.

NEW MACHINE TOOLS—delivered to manufacturing departments with all problems eliminated, proved performance, all necessary tooling, operation manuals and trained operating personnel—are the dream of all shop production supervision. This dream seldom comes true.

In a busy plant, new equipment often requires a bad cost and efficiency reputation before it begins to pay its way. Many improvements and innovations have been crowded into designs of new equipment. As a result, production machine operators lose great amounts of time in coping with the problems of becoming acquainted with new features and utilizing them to advantage.

If tooling is furnished with the machine in the fabricating area, work space becomes congested. Also, proper use of special attachments may not be understood. Therefore, the wrong kind of gleam appears in the supervisor's eyes when presented with brand-new equipment. Experience has taught him to expect nothing but headaches.

To deliver a complete machine tool package that can be put to work as soon as it is placed on the floor in manufacturing, a new concept has been developed at the El Segundo division of Douglas Aircraft. The program begins before the purchase of the new capital equipment and becomes a joint project because plant engineering, manufacturing and tooling have cooperated in the choice of the new machine.

When new equipment is delivered to the plant, instead of going directly into manufacturing it is sent to a machine development area that is entirely isolated from manufacturing. There, under top tooling supervision, equipment is proved under operating conditions, *Fig.* 1.

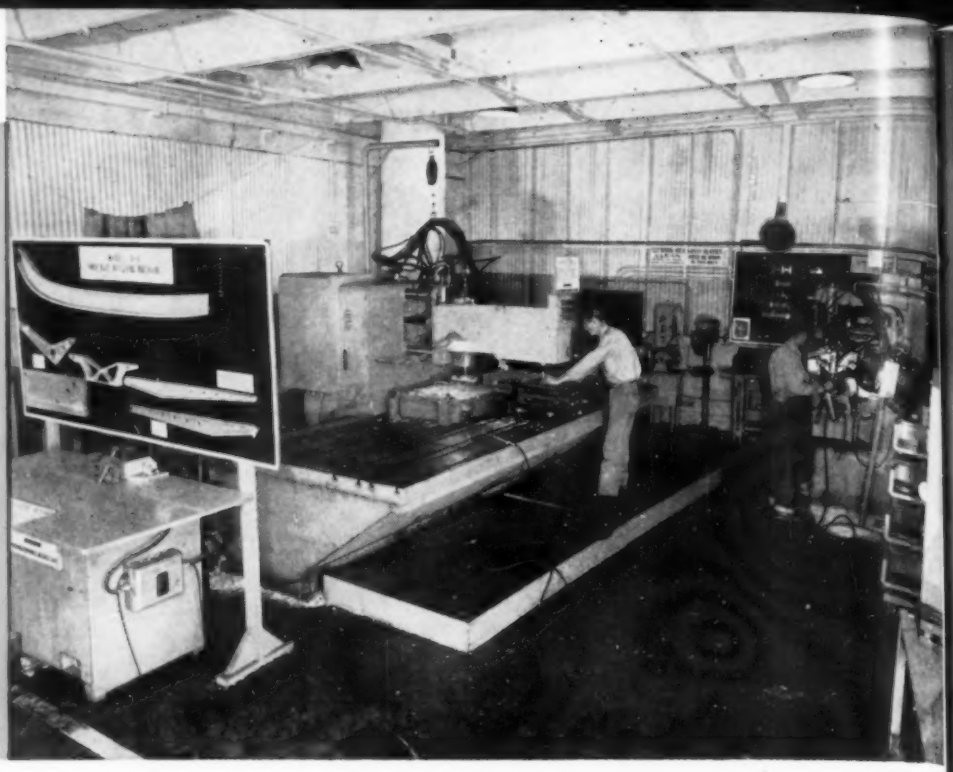


Fig. 2. In the machine development program, parts for production are planned, tooling is designed and test parts are run.

Representatives of the machine manufacturer are called upon for advice and guidance in installation and initial operation. There are certain peculiarities in any new machine and it is the purpose of this preliminary stage to eliminate them and to evaluate the machine limitations as well as capabilities. As the picture unfolds, parts to be made are analyzed and a sufficient number are sought to constitute a full load.

At the same time, tooling is planned, designed and put to use, *Fig.* 2. During this time, a machine operator is lent to tooling from manufacturing to help in the program. This operator is carefully selected because he probably will be the future operator of the machine. First he observes only. As quickly as he acquires the fundamentals, he takes over actual operation, *Fig.* 3.

Complete records are kept to show progress. Necessary shop practices are developed, remedies for the quirks of the machine are prescribed. In time, a complete operating procedure evolves and, when fully proved, it is written in manual form, *Fig.* 4.

This manual is also presented in a new type

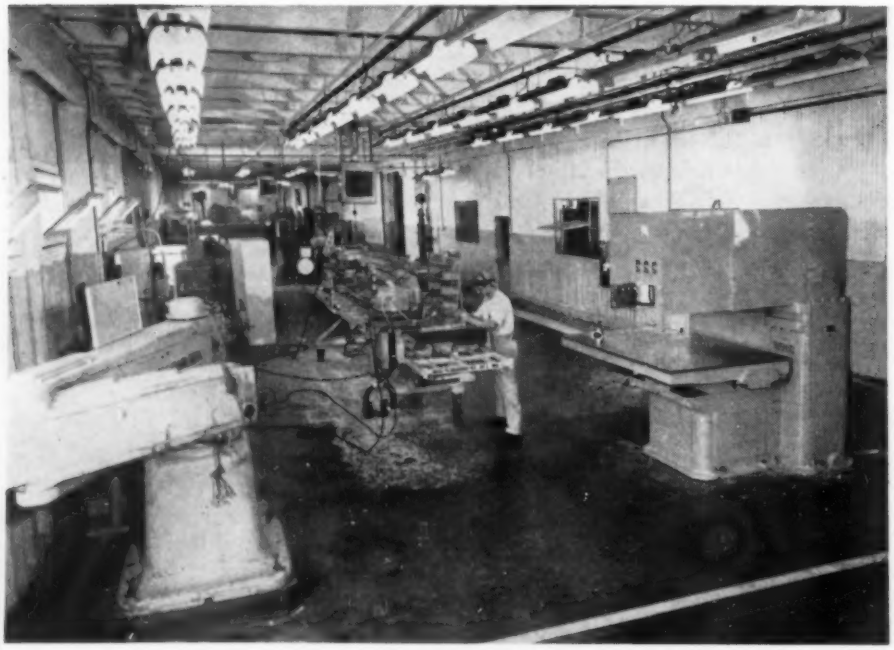


Fig. 3. While a machine is being proved, an operator is trained. He learns machine capabilities, its features and limitations under the guidance of trained personnel. When the machine is ready for production he becomes its operator.

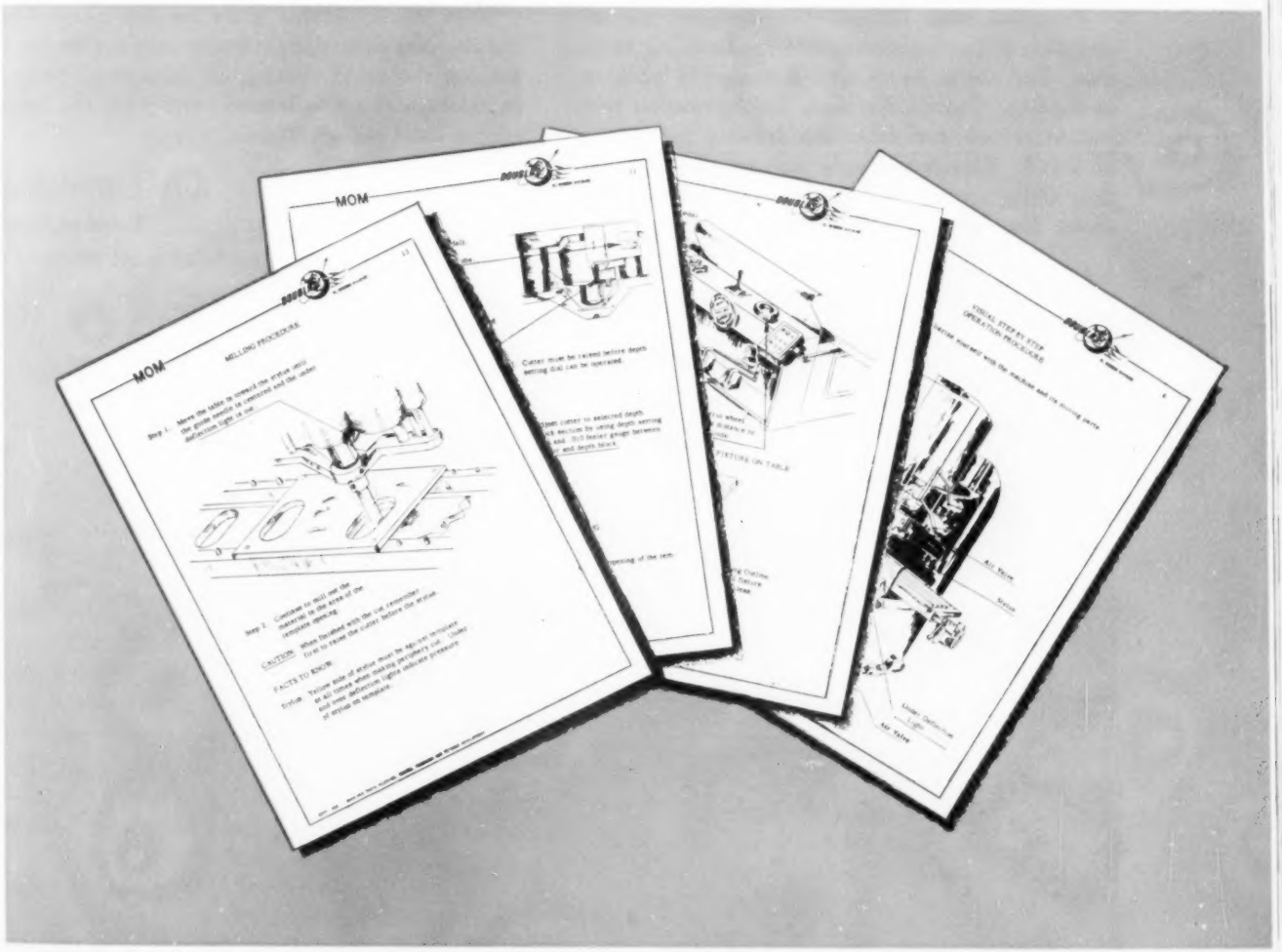
format. Instead of using the usual paper stock for the book, a special grease-proof sheet was selected. After printing, the sturdily bound manual can take severe shop punishment in any operating department and still be readable and useful for years. It will get dirty and greasy, certainly, but with the wipe of a clean cloth, the pages shed dirt immediately.

By the time the operating manual is printed, and it has a priority in the print shop, the operator who will run the machine is thoroughly trained. In addition, tooling is ready for production parts because planning has been informed of the scope of the machine and an adequate number of parts have been designated for production on it.

When this point is reached, the new machine with its complete operating package is moved into the shop, installed and integrated into the operating picture. When the machine takes its place on the production floor, there is no learning period for production personnel. The machine is a known quantity. It has scheduled work to do. It is accepted as a responsible member of the working team.

The machine development program is a functioning part of this Douglas-Navy aircraft plant. It conserves time and makes the capital equipment self-supporting in far less time than is usual under ordinary conditions. The tooling work force of the development area is highly skilled. Its personnel watches each step of a development and has wide experience for guidance. Each new machine put through the program increases that experience and facilitates proving the next machine.

Machine operators who are trained to operate the new equipment in the machine development area cannot help but absorb some of this assurance and experience. The association makes him a better machine tool man. Also, the shop supervisor takes a more receptive attitude toward new equipment and techniques, enabling him to concentrate his energies on solving production problems.

Fig. 4. Typical pages from a machine operating manual which was developed during the program and printed for guidance before the machine was installed on the production floor. The manual contains a general description of the machine and perspective sketches for illustrating operational procedure, tool-setting methods and proper location of workpiece in fixture, as well as pertinent facts about the machine.

Gadgets

Ingenious Devices And Ideas To Help The Tool Engineer In His Daily Work

Die Opener

Many dies and die sets are damaged in setup or teardown because of crude methods used in the die shop for this tedious and troublesome operation. Although special equipment is available for the purpose, many shops still rely on chain hookup, crane and hammer, especially for large dies. Conventional handling methods often result in damaged bushings or guideposts and hammer marks on die shoes, requiring expensive rework.

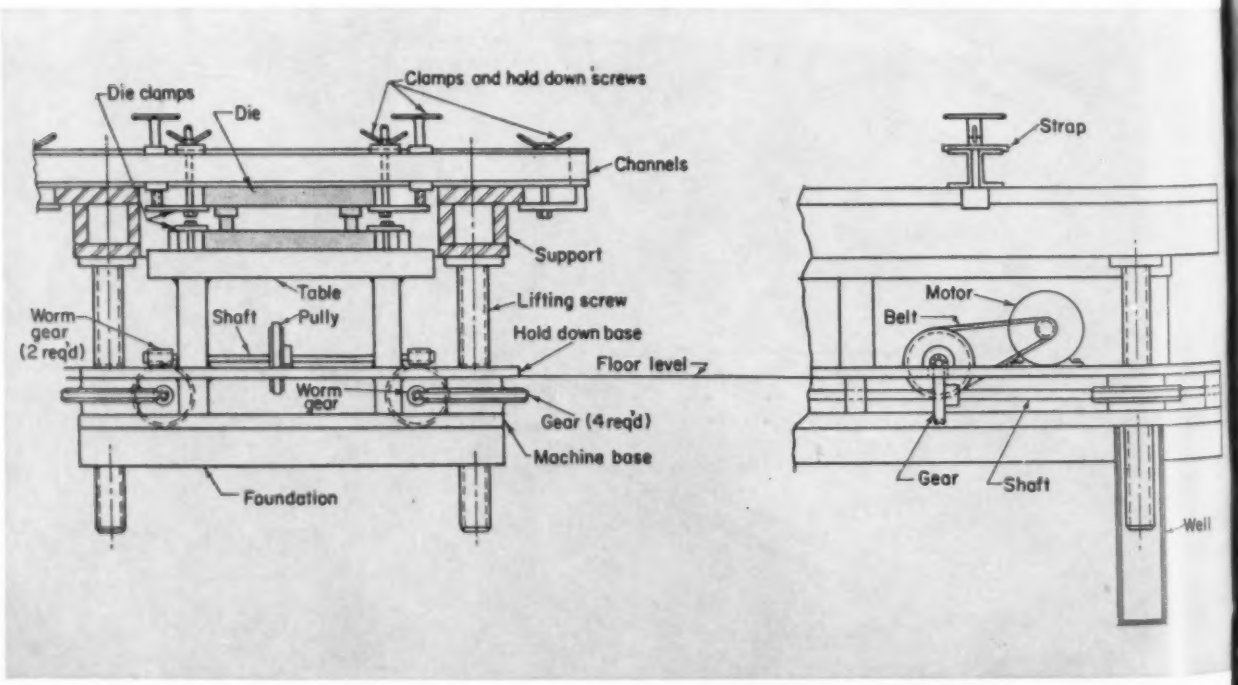
A die operating mechanism that can be built in the shop is shown in the accompanying sketch. This can be designed to accommodate the more common sizes of dies used. In addition to reducing handling time, the machine will also free much crane time as well as that of die-room men. The device can even be used for some tryout jobs, if carefully constructed.

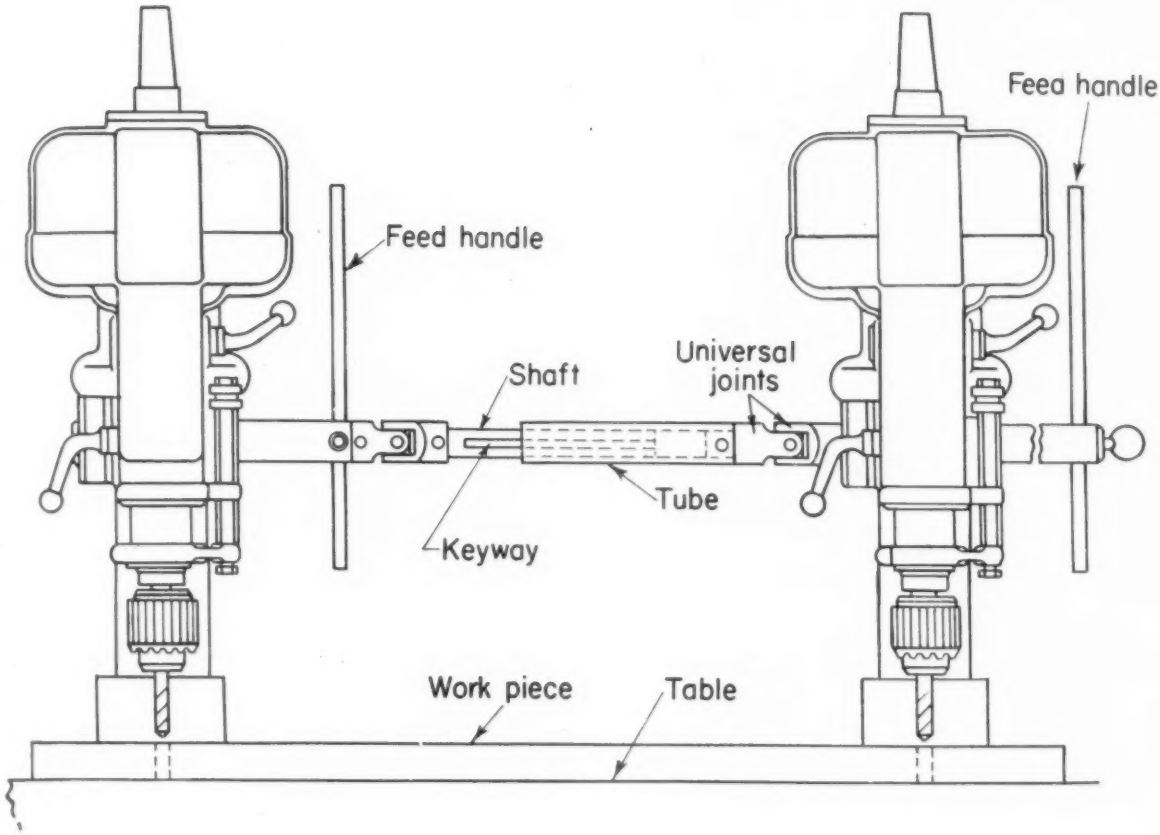
The mechanism illustrated is designed for installation in the foundation and for handling large dies. The die to be opened is shown in position in shading. Guards, dirt seals and lubrication provisions are omitted from the drawing for clarity of detail. Foundation wells are required for the four lifting screws. A hold-down base is provided above floor level to keep the gearing in place if a die goes together hard. On the bottom the die is clamped to a massive table top which is anchored to the machine base through heavy legs. The top half of the die is clamped to two channels welded together with spacers so they may be adjusted in and out to the size of die. The channels are supported on the lifting screws which are operated by individual worm gearing from a shaft driven by motor and pulley.

When a die is to be opened the channels are lowered to level of top of the table and the channels are spread out to permit loading of the die on the table. After the bottom die is clamped on the table, the channels are raised and moved in for clamping the top die. The strap arrangement shown in the detail sketch prevents the channels from bowing in heavy use.

Since this apparatus holds the dies parallel for opening and closing, tight-fitting ones can be forced without the usual cocking or damaging. Savings in die repairs are estimated to pay for the device over a short period of time.

L. H. Bobbitt
Toledo Chapter





Tandem Drill

Often an economical drilling arrangement must be devised for a flat strip of metal requiring a hole drilled at each end, or a similar component. The hole centers must be placed accurately in relation to each other. Satisfactory tooling is difficult for medium-sized batches.

Since sensitive drill heads can often be swivelled horizontally, the center positions of the two drill axes can often be preset so that it is unnecessary to move the jig holding the workpiece. In such an arrangement, the drill center distance is preset carefully. The jig holding the work is clamped firmly to the table top. By using available facilities and rearranging them as illustrated, drilling of the two holes is simply a matter of loading the drill jig and operating a single feed handle. Operator output is increased considerably.

In this setup the two pinions, which engage with the spindle quills for feeding, are connected together by means of a horizontal shaft. By pulling on either of the drill-fed handles both of the drill spindles are fed downward so that both holes are drilled by one pull of the handle.

The horizontal spindles carrying the pinions and feed handles of the drill heads are modified slightly so that universal joints can be fitted to each of them. Between the universal joints a telescopic shaft is fitted. One half of this shaft is tubular, the other half having a keyway which can engage a key in the tubular part. The universal joint allows placing the two feed pinion spindles out of line with one another—both vertically and horizontally. This arrangement permits the center distance between the drill axes to be increased or reduced to suit various jobs. The drills in the spindle chucks need not be of the same length, since one head can be positioned higher than the other; the universal joints insure a driving connection between the two heads.

The arrangement can also be used if the two holes in the component are of different diameters; speeds of the drill heads can be adjusted to suit the drill diameters, since they are independent units.

In fact, jigs can often be dispensed with even on shorter runs, and a simple locating arrangement bolted to the machine table to which the work can be secured with a pair of quick-acting clamps.

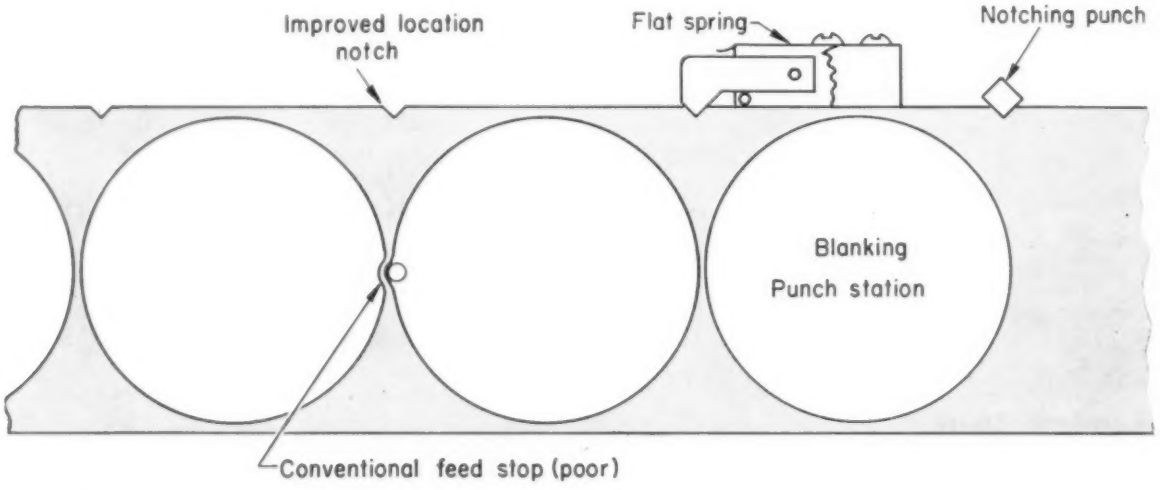
C. T. Bower
London, England

Notched Stop for Thin Strip

When blanking large disks of thin strip, stock trouble is often encountered if a conventional stop is located against the thin neck of metal between the blanked holes in the strip. This is particularly true of soft aluminum or copper alloy stock because of the weakness of the narrow neck. This difficulty can be eliminated by inserting a small rectangular set diagonally behind the blanking punch. This punch should notch the edge of the strip at the widest portion of the neck in the scrap where there is the greatest strength.

A simple spring-actuated L-shaped trigger can be mounted to engage this small notch and the strip can then be manually fed to the correct position without error and without danger of bending or buckling the blanked strip.

H. J. Gerber
Member-at-Large
Stillwater, Okla.



Triple-Acting Combination Draw Die

For the production of a small, eyelet-like workpiece, to be made from 0.01-inch sheet copper, only a standard, single-acting press was available. Since the required production rate was quite high, a combination die for both the blanking and the drawing process was designed.

Owing to the comparatively great deformation index (proportions between height and diameter of drawn cup) it was necessary to produce the workpiece in two drawing operations.

Consequently, the tool finally designed for the operation is a triple-acting die for three successive operations: blanking, initial drawing and definitive redrawing. The three operations are so combined that at each press stroke a complete workpiece is produced. The die is shown in open position in view *1* while views *2* to *4* illustrate partially and totally closed die positions.

In operation, the copper strip is fed through stock gages on the die holder. A standard stop-pin is used for registering the strip for the next operation. In the center of the stationary die holder there is a round hole containing a ring-like blanking die plate. In the blanking opening are the following concentric, telescoping tool members: a spring-actuated blank holder for the first draw; a stationary punch for the first draw, which also acts simultaneously as a drawing die for the redrawing; and a spring-actuated ejector.

The movable part of the tool consists of a punch holder which carries following concentrically telescoping members: a blanking punch, which functions also as a drawing die for the first draw; a blank holder for the redrawing, and a punch for the redrawing.

Of course, all punches, dies and blank holders are made of first-grade tool-steel, hardened and ground. The other members are made from a suitable, nonhardened cold-rolled steel.

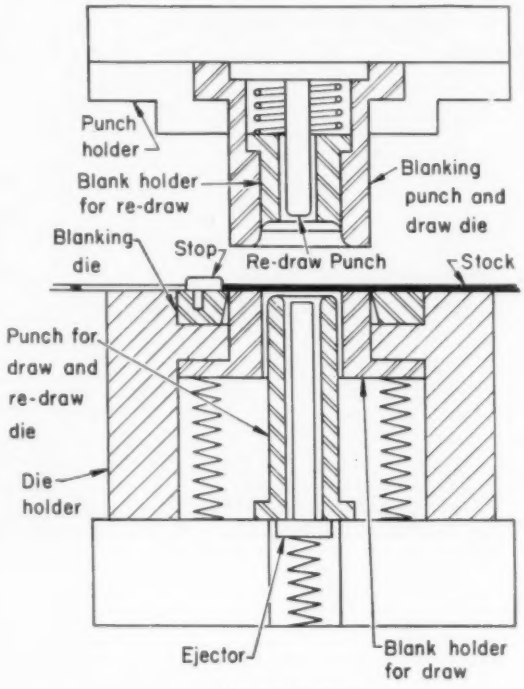
In operation, the strip is presented in its proper

position, and the press is actuated. As the movable part of the tool descends the blanking punch, in combination with the stationary blanking die-plate, blanks out the flat circular disk. This is then held firmly between the bottom surface of the blanking punch and the spring-actuated blank holder for the first draw, view 2.

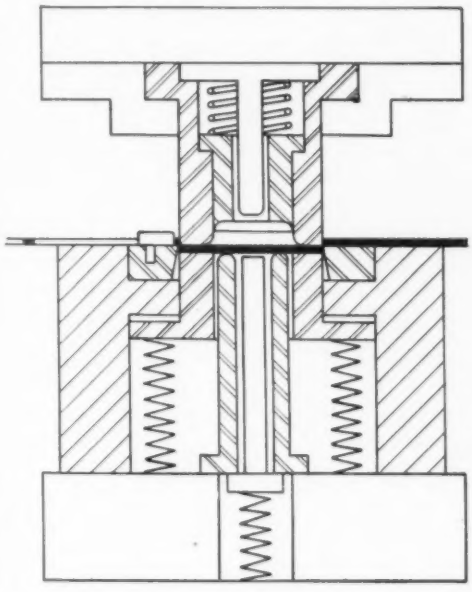
Next, as the press ram continues downward, the stationary (first draw) punch forms the flat disk into a predrawn cup, view 3. During further descent of the movable part of the tool the predrawn cup is redrawn, by a reverse draw, view 4.

Finally, when the press ram rises on the return stroke, the spring-actuated ejector throws out the finished cup from the redraw die.

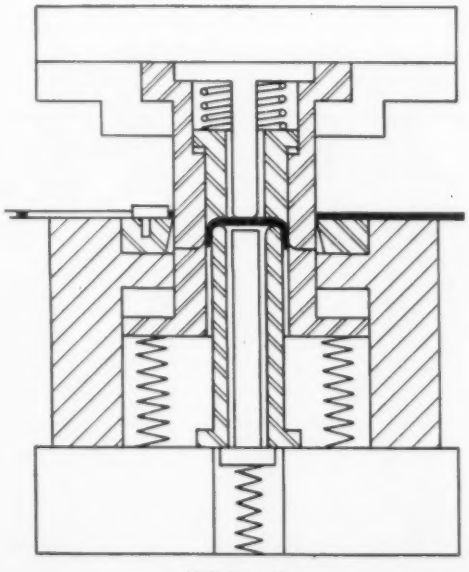
Federico Strasser
Santiago de Chile



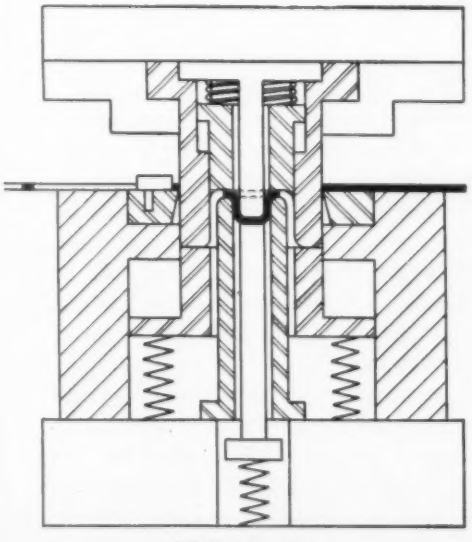
(1) Open position



(2) Blanking



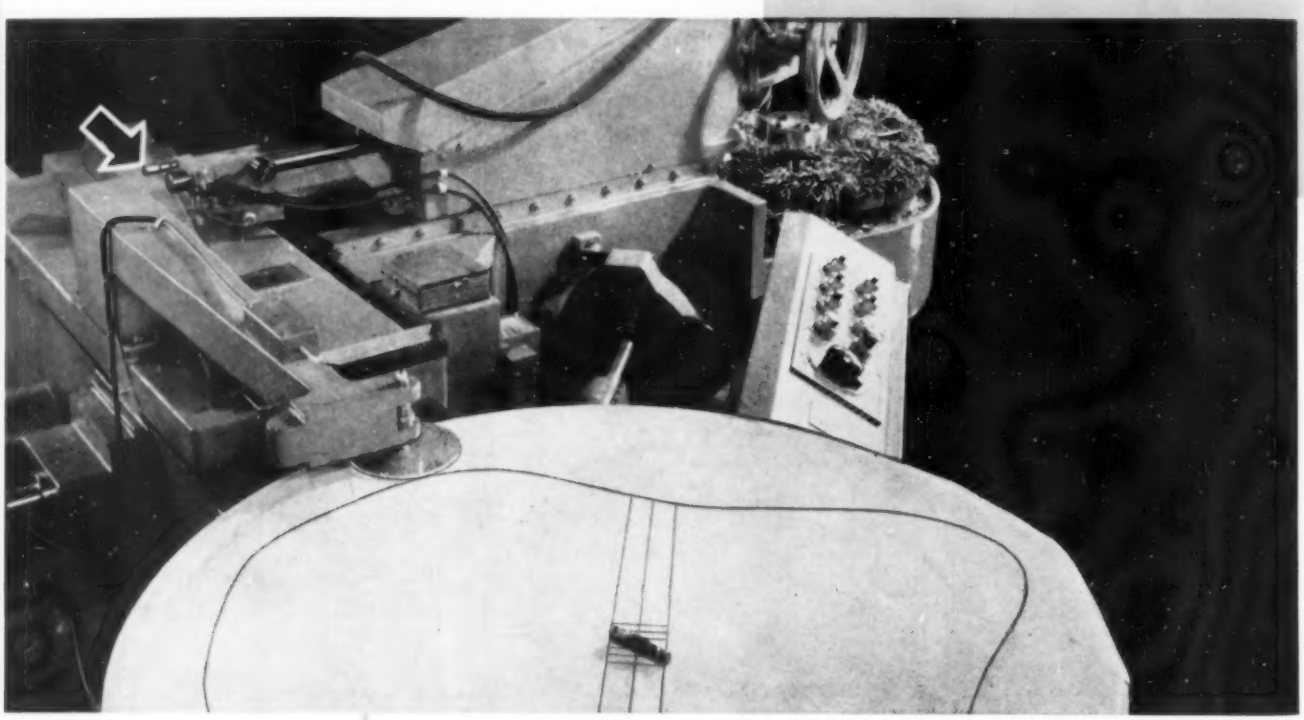
(3) Drawing



(4) Re-drawing

Cam

Fig. 1. Spark-gap tracer disk follows conductive line in this specially designed cam milling and grinding machine. Micrometer device (arrow) permits instant change to finish cut.



By Frank W. Hale
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PRODUCTION OF ORIGINAL MASTERS, as well as prototype quantities of external and internal edge cams, has always been expensive. Their costs have been far out of proportion to the unit cost of producing large quantities of duplicate shapes. In fact it has been necessary, as a minimum requirement, to furnish at least a sheet metal template and, for some cam machines, a hardened master made to close tolerances by laborious and highly skilled toolmaking procedures.

As a new approach to such cam milling and grinding problems, an electronic template and cam machine, designed and developed by The New England Machine and Tool Co. and distributed and serviced by Pratt & Whitney Co. eliminates the necessity of a master former. The machine, *Fig.* 1, is capable of following the edge of an easily prepared, electrically conductive line drawing while producing extremely accurate, two-dimensional, milled or ground contours.

Shown in *Fig.* 1 is a setup for milling an external edge cam from a 7-inch diameter by 1½-inch thick steel blank, tracing from an enlarged drawing. The conductive line drawing can be produced in 20 minutes from an accurate 5:1 enlargement layout of the cam periphery. The tracer disk (five times cutter diameter) accurately follows the edge of this line without touching it as the drawing table rotates. The cutter head, carried by the cross slide, moves proportionately toward and away from center of the synchronously rotating worktable, generating the required shape in the workpiece blank.

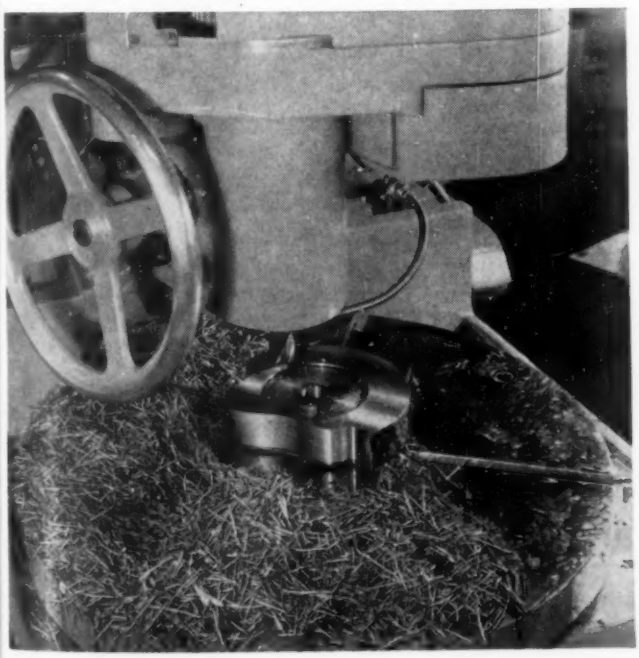
Machining

without a master former

The inset in *Fig.* 2 shows the progress of the roughing cut on this cam. The rise-and-fall data causes the 1-inch diameter end-mill to cut a full 1 inch wide path through solid material over two sections of the periphery. With the cutter turning at 240 rpm, and an average workpiece table and drawing table speed of 0.07 rpm (variable, under control of operator) this one roughing cut requires only 15 minutes. By means of a simple micrometer adjustment, the spindle-head cross slide is immediately repositioned for a finishing cut, allowing stock for grinding after hardening.

Originally used in the aircraft industry to generate two-dimensional cross-sectional contours of turbo-jet blades, buckets and vanes, the machine, *Fig.* 3, is arranged for both milling and grinding. It is particularly well-suited for extremely sharp changes in contour on both external and internal cam shapes which have high rise-and-fall data, *Fig.* 4. Vibrationless spindle speeds from 48 to 11,500 rpm permit milling with large or small cutters, as well as carbide milling and grinding operations on hardened cams.

Fig. 2. Milling operation, viewed from front of machine, with an end-mill feeding through solid material in one roughing cut.



Two completely noncontacting tracer-control systems and a novel ratio bar reduction mechanism, *Fig.* 5, are combined in this new method for milling two-dimensional cam shapes directly from a simple drawing which serves as a master for the tracer to follow. Using a dimensionally stable pencil-and-ink tracing cloth and conventional drafting instruments, a reproduction of any enlarged scale master cam layout can be traced with an electrically conductive "ink" in 15 to 20 minutes, accurate to within 0.005 inch. Only one edge of the line drawing must be accurate, the width, or variation in width, of the line being of no consequence. Any drawing errors are reduced in proportion to the ratio bar reduction being used, which can be set quickly for any desired ratio from 5:1 or larger, without upper limit. A special ratio bar is available for ratios between 1:1 and 5:1.

The machine, schematically shown in *Fig.* 5, is designed on a bed in the form of a right triangle. The rotary drawing table is located at the outboard end of the long leg of the triangle and the workpiece table at the outboard of the short leg. Forming a hypotenuse of the right triangle, a common drive shaft is fitted with nonbacklash worm-gear drives for both tables. From a variable-speed motor, through a transmission, both tables rotate in the same direction, either clockwise or counterclockwise, and always at equal speeds, from zero to 0.8 rpm.

The tracer, following the edge of the conductive line drawing, is a flat disk carried by a tracer arm mounted on a carriage (called the tracer slide).

Fig. 3 (right). Cam generating machine is arranged for milling or grinding operations. Tracer disk at left follows enlarged drawing as tables rotate synchronously. Ratio-bar reduction system causes cutter to generate the cam shape within precise tolerances.

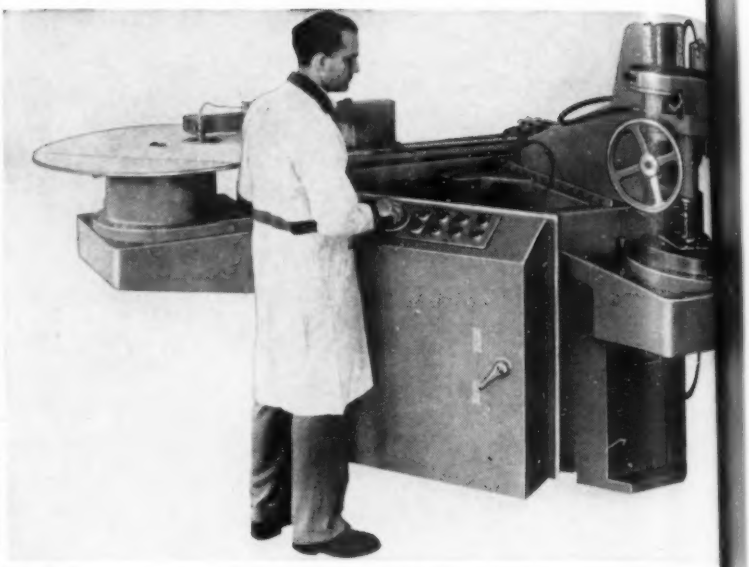
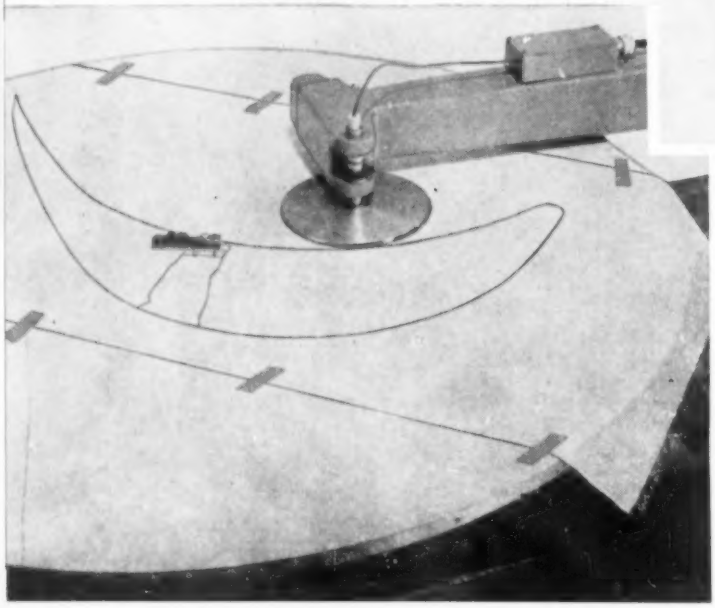


Fig. 4 (below). High rise-and-fall cam data evidenced by this cross section of a steam turbine blade can be followed by tracer control. Maximum reaction speed of tracer slide is 120 inches per minute. Inset shows milling of the cross-sectional template, which was produced with a 0.281-inch normal envelope over true shape.



This slide moves on the long leg of the rightangle bed toward and away from the center of rotation of the table. The slide is moved by a set of two magnetic clutches, each clutch having its own opposed drive to the carriage. One clutch is for motion toward and one for motion away from the center of rotation of the table. The electronic control functions to position the carriage so that there exists a 0.001-inch spark gap between the outside diameter of the tracer disk and the edge of the conductive line drawing as the table rotates.

Also mounted on the tracer slide, the adjustable reduction ratio bar can be pivoted during setup to control the ratio of reduction from the tracer slide motion to spindle slide motion. This produces the necessary motion to mill the actual size workpiece. Since the projected length of the standard ratio bar is 40 inches, in the direction of tracer slide motion, it is only necessary to divide the required reduction ratio into 40 inches to find the length of size blocks, *Fig.* 6, required to set the ratio bar to the proper angle. Adjustment of the reduction ratio bar is a relatively simple operation.

The cross slide, which carries the vertical cutter spindle head, slides on the short leg of the right triangle, toward and away from the rotational center of the worktable, in a direction at 90 deg from the tracer slide motion. A second set of two magnetic clutches controls the motion of this cross slide, these clutches being under control of a second electronic pickup which serves to follow the straight angular edge of the reduction ratio bar. Thus the cutter spindle moves in an exactly similar path to that of the enlarged drawing but at the actual scale.

The electronic pickup is capable of "following" within 0.0002 inch. Thus an accurate and uniform contour can be produced, since it is recognized that the purpose of the reduction principle is to reduce errors. Possible errors of 0.005 inch may exist in the average-to-good conductive line drawing, and in such a case the maximum error from the drawing to be expected in the finished workpiece, when reducing at 10:1, would be 0.0005 inch. Larger scale master layouts, and correspondingly larger reduction ratios will, of course, produce greater accuracies.

If it is desired to produce a cam of greater accuracy than can be obtained from the maximum enlargement drawing which can lie on the largest rotary table available, two other methods are available:

The first consists of using as a master an enlarged template instead of the silver-line drawing. Such a template can be made as accurate as time and facilities permit, any errors being reduced in the machining process.

The second method can be best described by the following example: Shown in *Fig.* 7 is the milling of a small external edge cam which was required to be produced with polar coordinate tolerances of ± 0.0005 inch. A forecast of possible accumu-

lated errors determined that a 10:1 reduction ratio was required. Although larger drawing tables can be furnished, the 10:1 enlarged drawing was too large for the 36-inch drawing table available. For this reason the "base circle reduction method," *Fig.* 8, was used. Reducing all polar coordinates (measured to the path of center of the cam-follower) by a constant (radius of an assumed base circle) before making the enlarged 10:1 layout, produces a distorted shape, smaller than a true enlargement layout, but possessing the same degree of enlargement of the rise-and-fall data.

A "center-point" tracer, *Fig.* 9, is then used to follow the enlarged silver-line representation of the path of the center of the cam-follower, while the cam is cut using an end-mill of a diameter equal to the cam-follower. The same micrometer setting device as used for adjusting from rough to finish cuts is used to back off the cross slide by an amount equal to the radius of the assumed base circle.

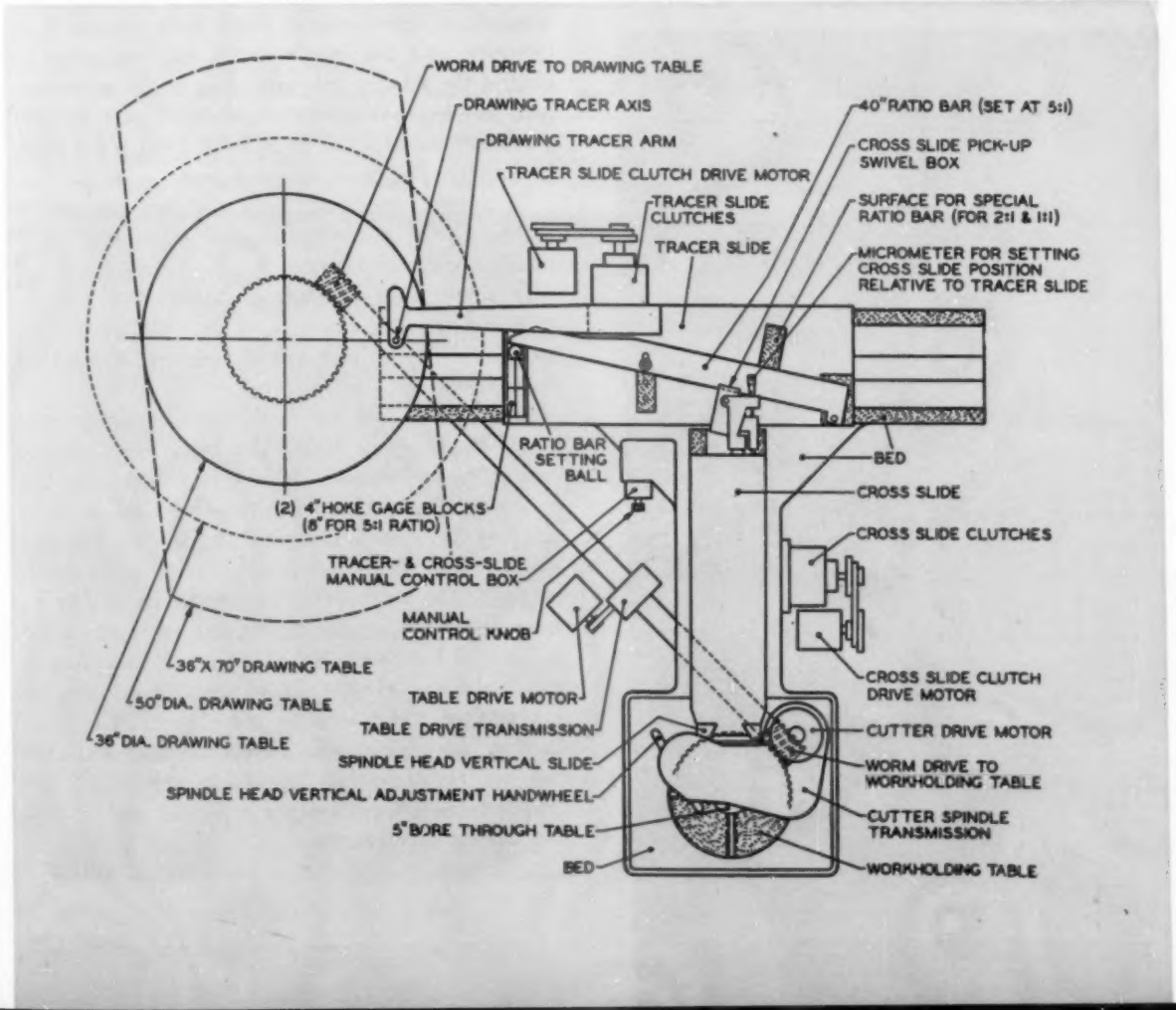
In order to understand the significance of novel tracer control system, it is very important to recognize the limitations of other conventional systems. In all conventional transducers which require contact of the tracer stylus with the master or model, it is necessary to incorporate some degree of mechanical complexity so that both side forces and axial forces on the stylus will have approximately the same effect in producing a signal. Furthermore, these moving mechanisms in such transducers result in a time lag between actual change and signal output.

The new spark-gap tracer accomplishes the same result without these disadvantages. It delivers the desired signal whenever any portion of the stylus approaches, but does not contact, the model. It is instantaneous in its action, since no mechanical movements are utilized.

Former transducers which require the smallest operating force produced the smallest signals. The spark-gap noncontacting tracer delivers a high number of volts per unit of error and the related circuitry is exteremely simple. The result is a simple tracer control which exerts zero operating force against the model, has a high speed of response, involves no mechanical time lag, gives a large output signal and has inherent flexibility.

Operationwise, a high voltage, low amperage, harmless current is applied to the tracer point or stylus. As this stylus approaches the electrically

Fig. 5. Schematic plan view of the electronic template and cam machine illustrates right triangle design, with common drive shaft for rotating drawing and worktables. As tracer slide moves to cause tracer disk to follow drawing, cross slide moves to follow edge of ratio bar, producing required reduction of motion at cutter spindle.


WORM DRIVE TO DRAWING TABLE
DRAWING TRACER AXIS
DRAWING TRACER ARM
TRACER SLIDE CLUTCH DRIVE MOTOR
TRACER SLIDE CLUTCHES
TRACER SLIDE
40"RATIO BAR (SET AT 5:1)
CROSS SLIDE PICK-UP SWIVEL BOX
SURFACE FOR SPECIAL RATIO BAR (FOR 2:1 & 1:1)
MICROMETER FOR SETTING CROSS SLIDE POSITION RELATIVE TO TRACER SLIDE
RATIO BAR SETTING BALL
BED
CROSS SLIDE
CROSS SLIDE CLUTCHES
(2) 4"HOKE GAGE BLOCKS (8"FOR 5:1 RATIO)
TRACER- & CROSS-SLIDE MANUAL CONTROL BOX
MANUAL CONTROL KNOB
36"X 70" DRAWING TABLE
50"DIA. DRAWING TABLE
36"DIA. DRAWING TABLE
TABLE DRIVE MOTOR
TABLE DRIVE TRANSMISSION
SPINDLE HEAD VERTICAL SLIDE
SPINDLE HEAD VERTICAL ADJUSTMENT HANDWHEEL
5"BORE THROUGH TABLE
BED
CROSS SLIDE CLUTCH DRIVE MOTOR
CUTTER DRIVE MOTOR
WORM DRIVE TO WORKHOLDING TABLE
CUTTER SPINDLE TRANSMISSION
WORKHOLDING TABLE

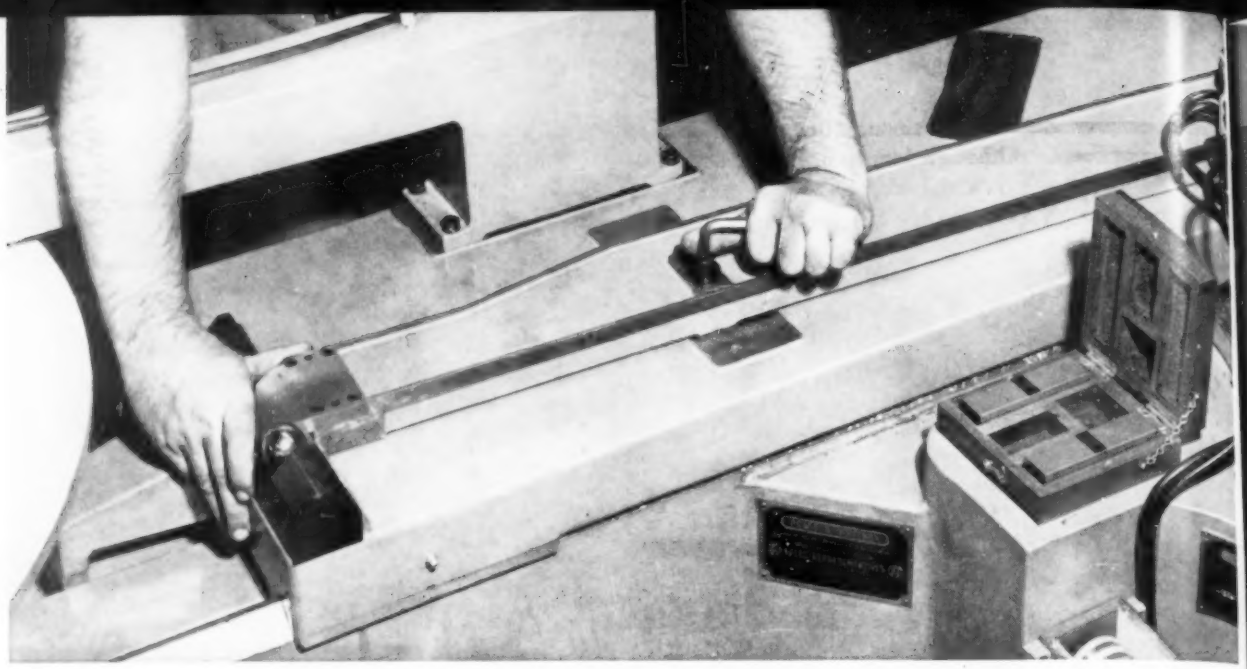
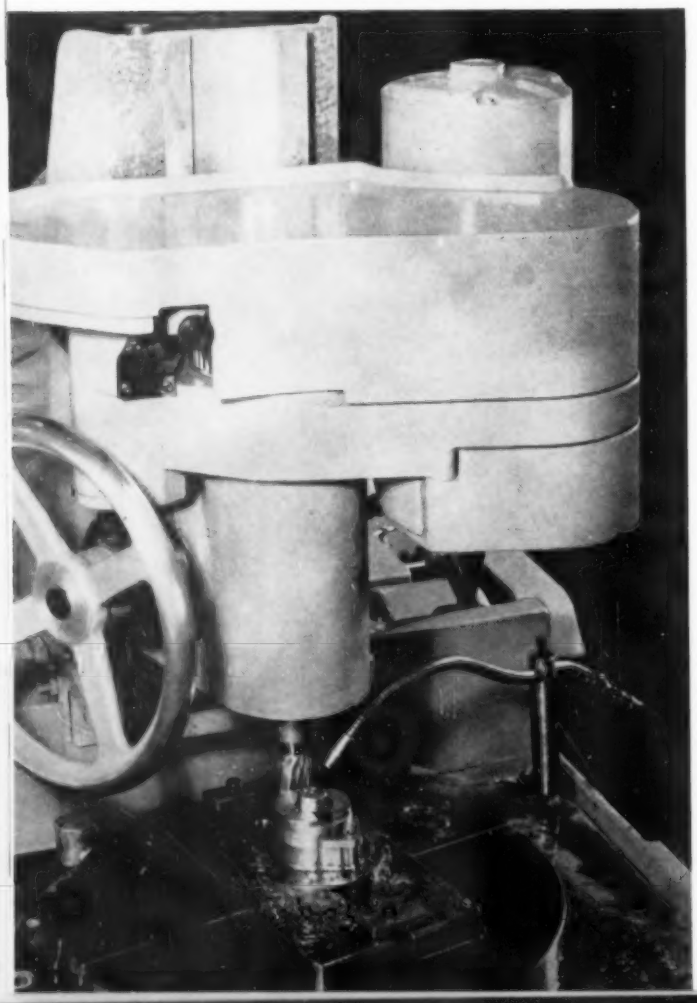


Fig. 6 (above). Operator adjusting ratio bar. Pivot at right-hand end of bar (not shown) is offset in front of the master edge by an amount equal to radius of the ball (near operator's hand). Setting for any ratio of reduction is determined simply by dividing the ratio into the bar length, the quotient being the required length of gage-blocks, shown inserted between ball and end of trough.

Fig. 7 (below). Milling a small control cam in a fixture designed to stack several parts. The cutter diameter is equal to the cam-follower, since drawing is a representation of path of cam-follower center, rather than actual cam periphery.



grounded "silver line" (or ratio bar edge, in the case of spindle head cross slide), a spark will jump. Since the length of the spark-gap is proportional to the voltage across the gap, this voltage is utilized in the electronic control circuits as a measure of the length of the gap. Electronic "anticipation" circuits serve to measure the rate of extremely minute changes in the gap, thus tremendously speeding up corrective signals and avoiding oscillation.

Ouptut of the electronic circuits consists of two channels of direct current which vary oppositely in intensity with the length of the gap and serve to control the relative magnetic flux in the associated pair of electro-magnetic clutches. These clutches drive the tracer slide, or spindle head cross slide, to maintain the constant spark gap.

In normal operation both clutches are always driving and slipping, the relative amounts of energization determining the direction and speed of slide movement. Further, each clutch is geared, independently and opposed, to the slide, precluding any possibility of backlash at points of directional change.

With this smooth but "stiff" tracer control, variations in the spark length are much less than the best milling tolerances. It is expected that the use of this spark-gap tracer control—invented and patented by Mr. Paul J. Campbell of The New England Machine and Tool Co.—is not limited in its application to the equipment discussed. Its ability to trace extremely fragile models has prompted some to name it the "soap bubble" tracer. In reality it will trace any electrically conductive surface, or any surface which can be made electrically conductive. Its high speed of response makes it suitable for rather special machining operations. Its simplicity should recommend it for the more standard tracing applications.

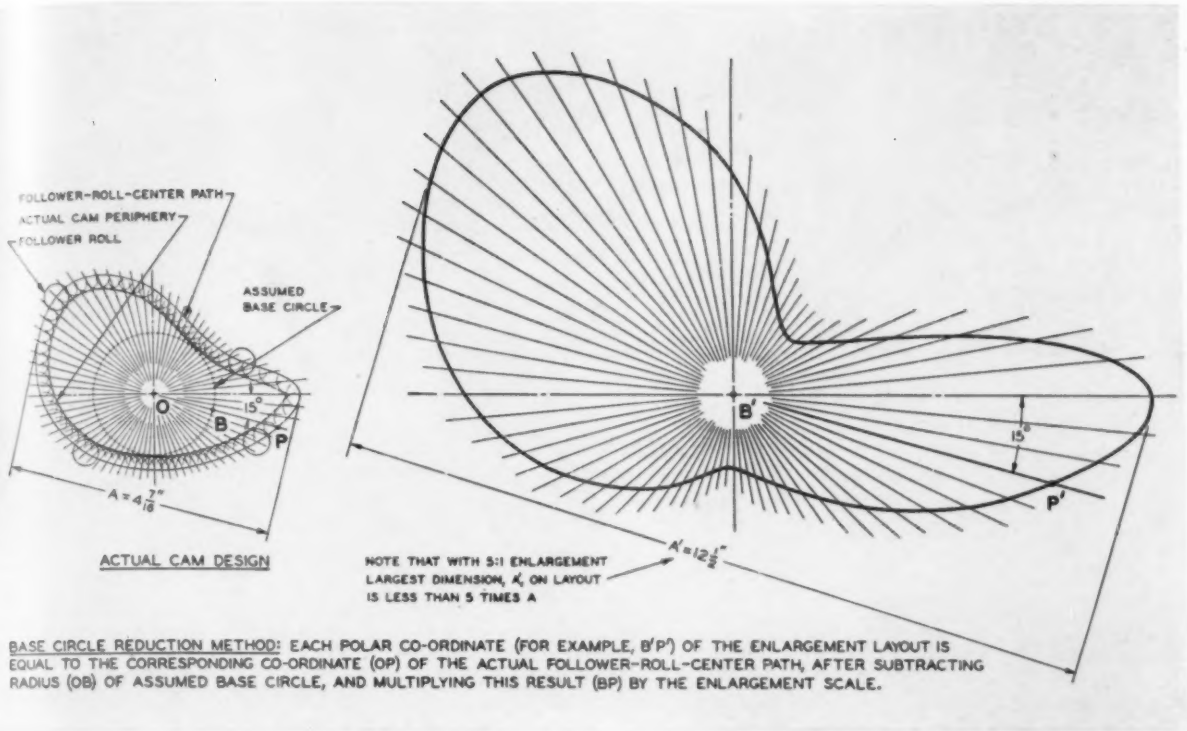
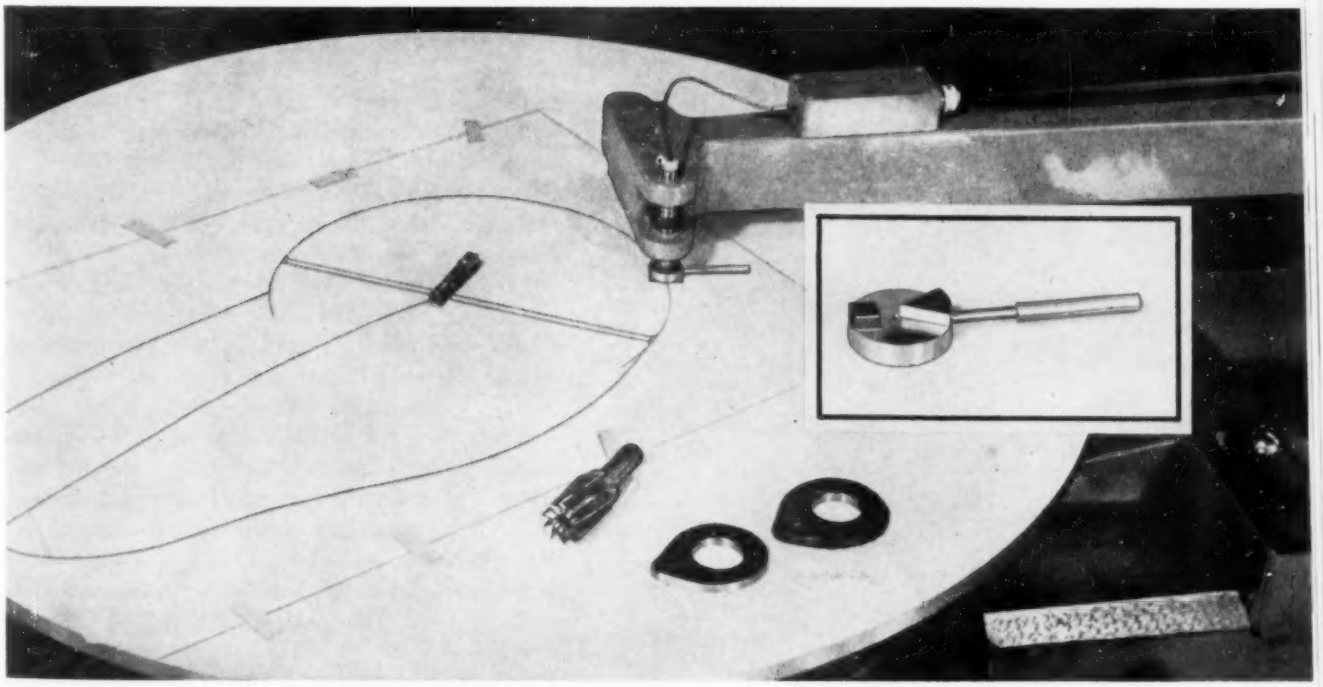

FOLLOWER-ROLL-CENTER PATH
ACTUAL CAM PERIPHERY
FOLLOWER ROLL
ASSUMED BASE CIRCLE
O
B
P
15°
A = 4 7/16"
ACTUAL CAM DESIGN
B'
P'
15°
A' = 12 1/8"
NOTE THAT WITH 5:1 ENLARGEMENT LARGEST DIMENSION, A', ON LAYOUT IS LESS THAN 5 TIMES A
BASE CIRCLE REDUCTION METHOD: EACH POLAR CO-ORDINATE (FOR EXAMPLE, B'P') OF THE ENLARGEMENT LAYOUT IS EQUAL TO THE CORRESPONDING CO-ORDINATE (OP) OF THE ACTUAL FOLLOWER-ROLL-CENTER PATH, AFTER SUBTRACTING RADIUS (OB) OF ASSUMED BASE CIRCLE, AND MULTIPLYING THIS RESULT (BP) BY THE ENLARGEMENT SCALE.

Fig. 8. Decision on ratio of reduction, and therefore size of enlargement layout, is based upon accuracy requirements. If size of the cam and its accuracy demand a layout too large for drawing table the base-circle reduction method is used. Although this process produces a distorted shape, the layout is much smaller than a true enlargement, yet rise-and-fall data is maintained at required enlargement, and greater accuracies of machining are assured.

Fig. 9. Setup for generating the cam shown in *Fig.* 7 by the method described in *Fig.* 8. Shown is a rough forging and finished cam as well as the cutter of cam-follower diameter. Drawing was traced from master layout, using silver ink and conventional drafting instruments. Since drawing represents path of cam-follower-center, a "center-point" tracer was used, shown removed and bottom side up in the rectangular inset. Sector-cuts on tracer meet exactly 0.001 inch back of center so that tracer axis follows precisely on edge of line.



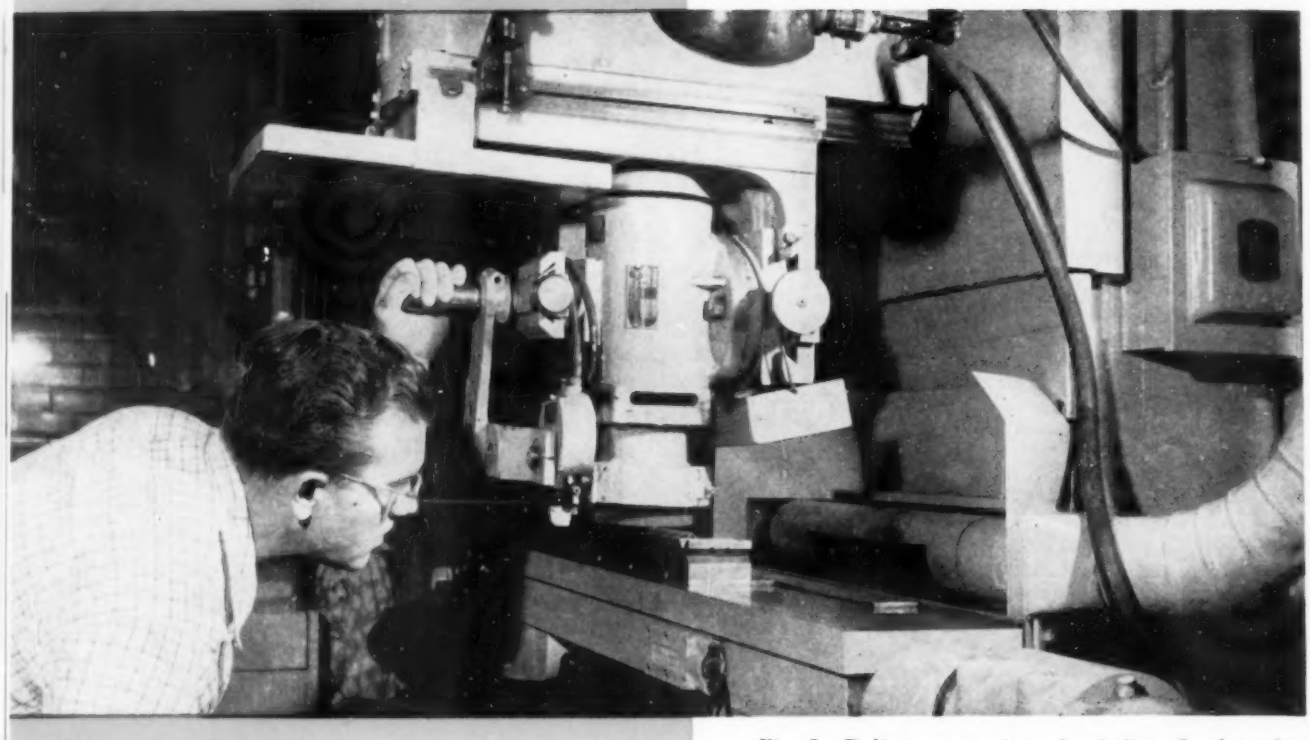


Fig. 1. Delicate operation of grinding flat broaches is performed in toolroom of Ford Mound Road plant, using resin-bonded aluminum oxide wheels.

GRINDING HIGH-SPEED STEELS with resin-bonded wheels

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and
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INCREASED USE OF THE NEWER TYPES of high-speed steels has made desirable improvements in toolroom grinding. Response to this need has resulted in the recent development of a resin-bonded grinding wheel which has proved advantageous for many applications, *Figs.* 1 and 2. Experience with it has been accumulated in a number of metalworking plants.

It is reported that these wheels provide faster cutting action, lower grinding costs, finer finish and improved wheel life, in many instances, compared to conventional wheels. Indications point to the fact that tool life is improved through finer finish and reduction of heat damage in grinding.

In bond, grade and structure the wheels are similar to those used for carbide tool grinding, as discussed in the November 1953 TOOL ENGINEER, "Carbide Tool Grinding with Resin-Bonded Wheels." Essentially, only the abrasive has been changed. In place of the silicon carbide used for carbide tools, a special friable fused alumina abrasive is used for the high-speed steel applications. The relative friability of the special abrasive is shown in TABLE 1.

Use of special friable alumina helps insure a cool cutting action. This prevents tool damage due to

*Senior member ASTE Detroit chapter

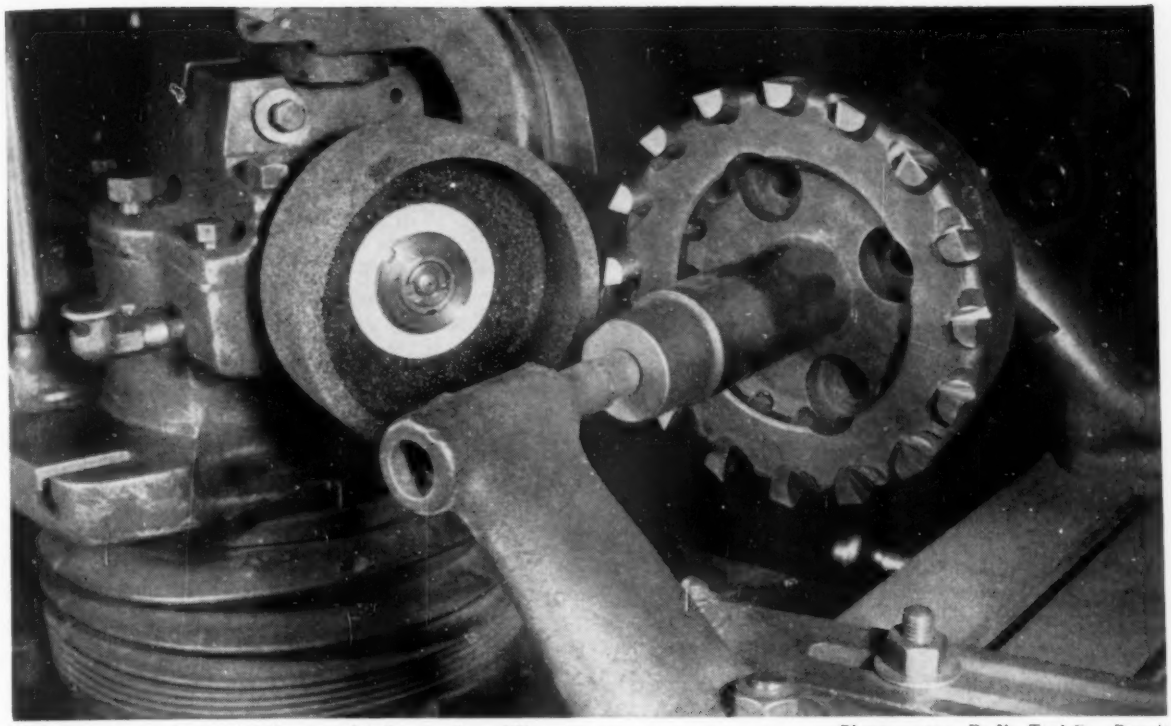


Fig. 2. Setup for grinding multiple tooth milling cutter with a resin-bonded wheel.

—Photo courtesy Re-Nu Tool Co., Detroit

thermal shock, frequently troublesome during regrinding operations. Of prime importance is the ability of this resin bond to release the abrasive at the proper instant to get desired results without creating excessive heat.

The resilient action of the resin bond enables the wheel to produce an unusually fine finish even when the operator uses a coarse grit for fast cutting action. In a typical case, for example, a 46-grit resin-bonded wheel gave a finer finish and faster cutting action than a 60-grit vitrified wheel. In other words, a resinoid wheel with coarser grit than is normally selected in other types can be used to get a faster rate of stock removal per pass and still obtain a satisfactory finish on the tool.

The strength and toughness of the resin bond sometimes make it possible to safely reduce the thickness of Type 1 straight wheels or change from Type 12 dish or saucer wheels to Type 1 wheels. This may effect a saving on the initial cost of wheels, if other factors do not preclude the possibility of making such a change.

Table 1—Comparison of Friability of Various Abrasives

Abrasive	Toughness Index	
White Alumina	25	Most Friable
Special Friable Alumina	35	
Friable Alumina	42	
Regular Alumina	54	Toughest

As with most grinding equipment, the performance of resin-bonded wheels is largely dependent upon the way they are used. Reports on their performance from different users vary considerably, as do the grinding techniques employed. The over-all picture obtained from extensive use in the field indicates that the resin wheel has a definite place in tool-grinding operations.

Shown in TABLE 2 are typical performance figures for resin-bonded Type 6 cup wheels, 5 x 2 x 1¼ inch, on M-2 and M-3 steel flat broaches ground on a Thompson flat broach grinder in an automotive plant. These broaches varied in size from 9 inches long and 1 inch wide to 36 inches long and 9 inches wide. During these tests, the wheel demonstrated it was capable of taking heavy cuts without creating any appreciable taper from one end of the broach to the other, even on the 36-inch length broach. Also, by use of resin-bonded wheels, the operators found that it was not necessary to dress the wheels as often as on the type of wheels previously used. Resin wheels were dressed about every 12 to 13 broaches, whereas vitrified wheels previously had to be dressed two or three times for each broach ground.

On several tests, tools that had been resharpened with the resin-bonded wheels were followed through production to determine the effect improved finish would have on the number of production units produced between grinds. It was found that the finer finish actually increased the tool life between

Table 2—Performance of Cup Type Resin-Bonded Grinding Wheels on Flat Steel Broaches

Specification	Ave. Wheel Wear (in./broach)	Broaches Ground per Dressing (No.)	Calculated Wheel Life Total (No. of broaches)*	Wheel Cost per Broach Ground ($)
11A46-N-13-BC	0.0040	13	406	0.0079
11A601-N14-BC	0.0047	12	345	0.0093

*Based on 1½-inch usable cup wheel thickness, and grinding 40 broaches.

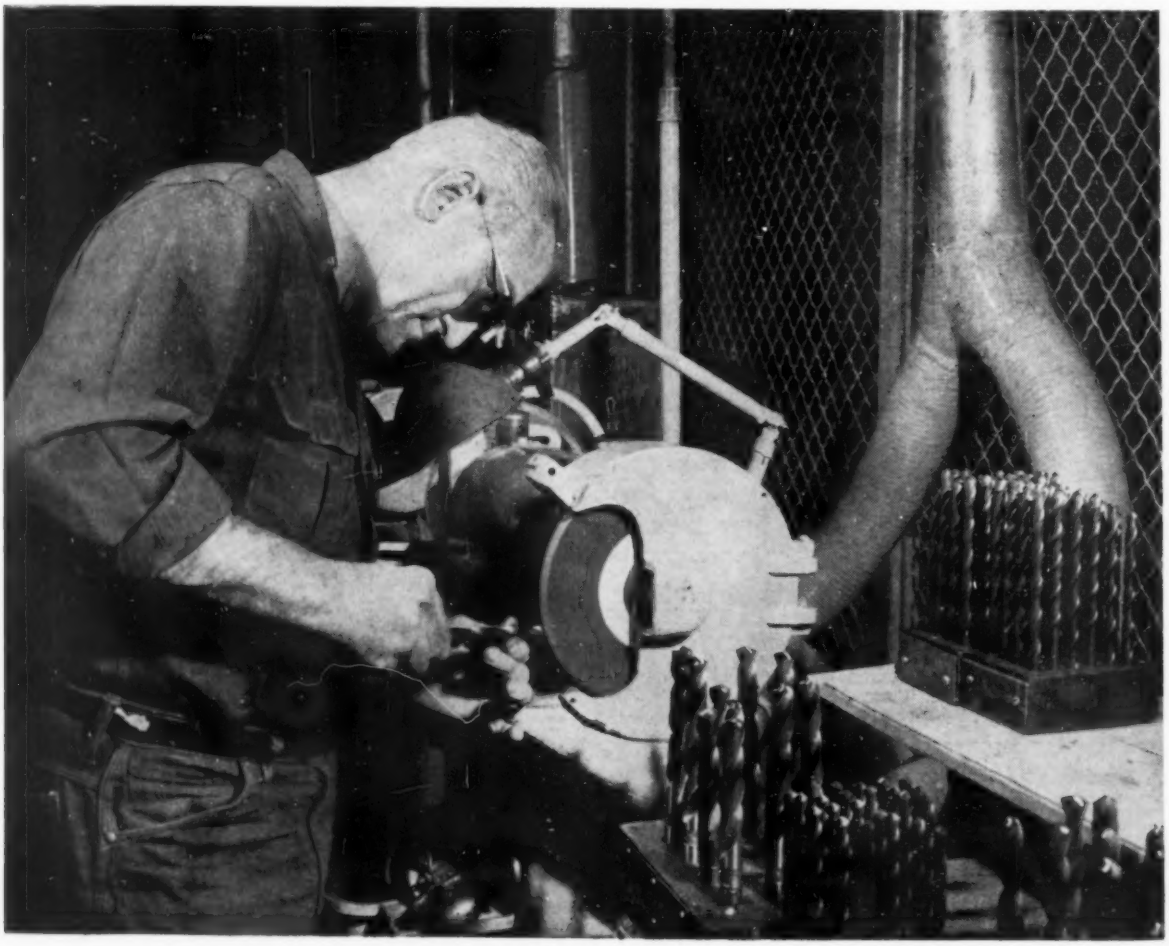
grinds by as much as 50 percent on several operations. In addition to the increased production life of the tools between grinds, the amount of metal removal necessary to recondition the tool was considerably less. This it is believed, is a result of the finer cutting edge finish, which produces more pieces before a "peel back" or dulling commences.

On round broach grinding tests, essentially the same results were revealed. Operators on the grinders found they could finish grinding a broach much faster with far less wheel dressing and produce a much finer finish, even on such steels as T15 and M15. These tungsten-vanadium-cobalt type high-speed steels, recommended for extreme abrasive resistance, have constantly presented a difficult grinding problem.

Another application on which these wheels have proved successful is on fluting of drills or thinning the webs after the drills have been pointed. *Fig.* 3. These same wheels, when worn to a small diameter, can be used for resharpening thread chasers. This is typical of the versatility of the resin-bonded wheels. They are adaptable to various applications, making it possible to reduce the number of different wheels carried in stock for tool grinding.

In the past, it frequently was necessary to stock one wheel for roughing and one for finishing each type of job. Now it is possible to minimize the grinding wheel inventory since one wheel will do both rough and finish grinding. Based on these considerations, it is likely that resin-bonded toolroom wheels will find ever greater use as more tool engineers become acquainted with their qualities.

Fig. 3. Sharpening and fluting of drills, such as this operation in Ford Mound Road toolroom, are advantageously performed on resin-bonded wheels.



tool engineering solves installation problem

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San Francisco Naval Shipyard
San Francisco, Calif.

INSTALLING STEAM CATAPULTS on aircraft carriers involves many difficult machining and aligning problems. The procedure developed by the San Francisco Naval Shipyard, *Fig.* 1, was evolved as the most logical method to provide satisfactory alignment and accuracy necessary for the successful operation of this high-speed machine.

Briefly, the steam catapult is made up of two slotted cylinders extending 240 feet in length. Steam pistons in the cylinders have attachment through the slots, flexibly connected to a wheeled airplane-launching shuttle. This shuttle in turn travels in a continuous track. Steam sealing is accomplished by a single strip in the cylinder slot area. With the high acceleration, loads and velocities employed, alignment must be accurate to provide satisfactory operation and to avoid excessive wear of components. The ultimate alignment of the catapult machinery depends on the machined seatings in a trough which is part of the ship's structure.

Previously, the method used was to machine

Opinions expressed in this article are those of the author and not necessarily those of the Department of the Navy.

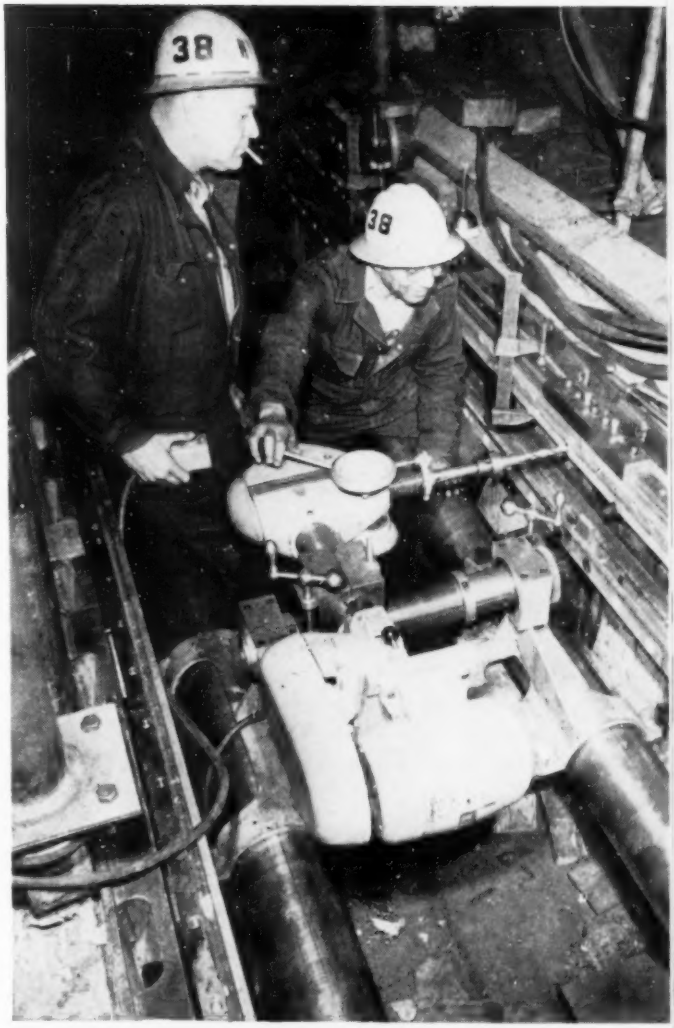


Fig. 1. Portable tooling for drilling for rail supports in catapult trough.

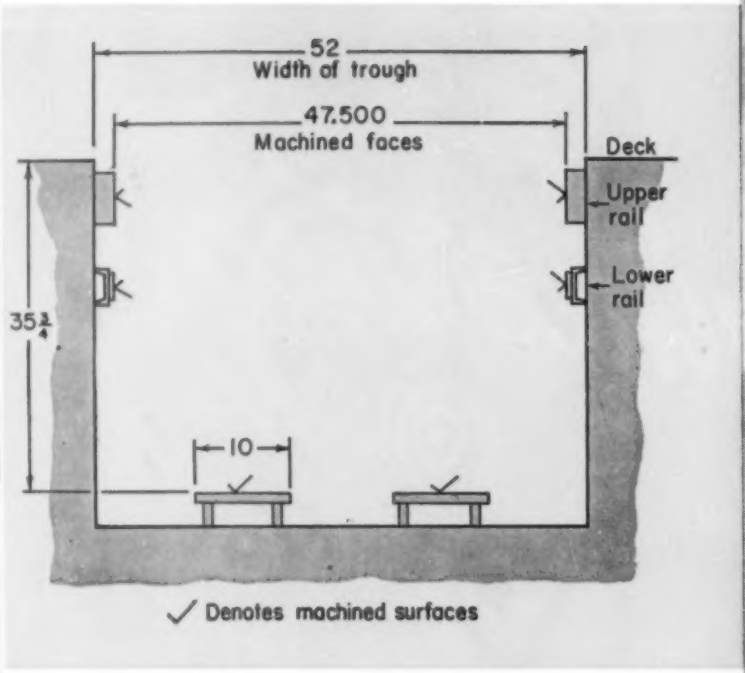


Fig. 2. (above) Cross section of catapult trough showing machined surfaces.

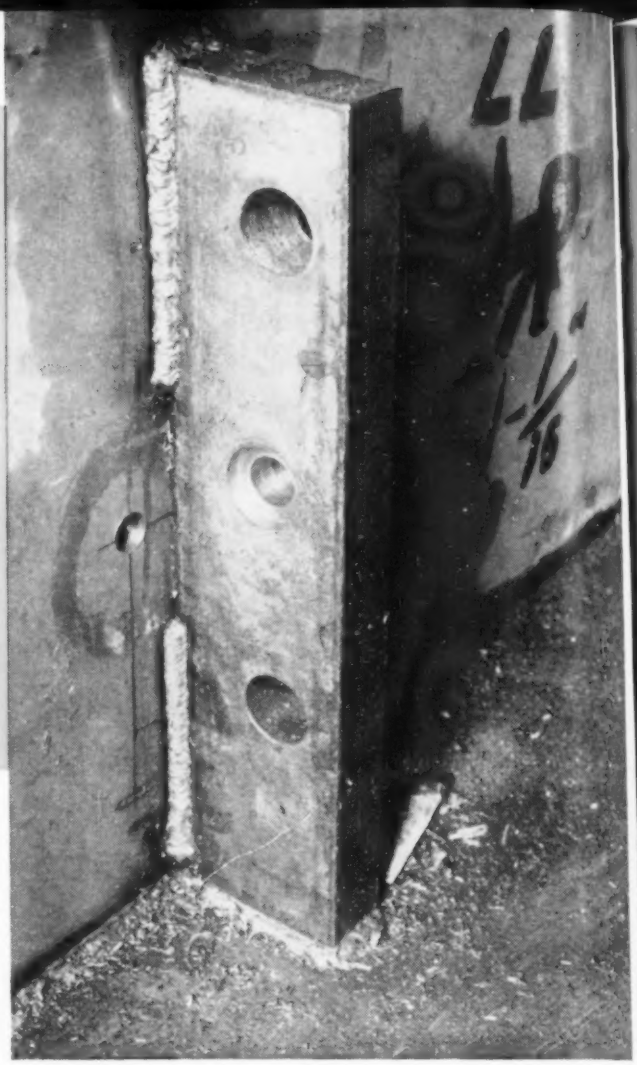


Fig. 3 (right) Tooling clip in trough showing reamed and counterbored hole. Clips are used for machining and aligning operations.

lengths of catapult trough to finished dimensions in the inside machine shop. The machined sections were then welded into longer lengths and installed in the ship. In spite of relative accuracy, precise optical methods, and careful control, a slow and difficult process of field chocking and hand fitting was necessary to obtain workable alignment. A typical cross section of this trough is shown in *Fig.* 2.

In contrast to the usual shipyard outside machine job and because of its large magnitude, tool engineering proved vital in programming this task and establishing a new standard of accuracy and production for outside (portable) machine work. Engineeringwise—if the requirements of power, speed and rigidity were met—portable type tooling could rival inside machine processes. This philosophy was sustained in the finished results.

The decision to machine in place aboard ship was reached as the only logical engineering conclusion after consideration of all factors. It was further concluded that if accuracy was built into the required tooling, then uniform cross-section geometry and dimensions would result. From past ship experience, it was known that straightness of the trough would vary with time of day, temperature and with ship movements. After an optical check of conditions aboard ship, it was decided to confine optical work to the cooler hours during the night when the most stable conditions prevail.

The entire tooling program and procedure was engineered by the Shipyard Design Division, Marine and Mechanical Engineering Branch. Accuracy and finished dimensions were built into the equipment. These factors were paramount in the resulting accurate and uniform finished job. The following relates chronologically the procedure on this project.

Catapult Trough: The catapult trough sections are fabricated by the structural shop in 20-foot lengths, using a special fixture to insure straightness and uniform section. Trough material is $\frac{5}{8}$ inch thick armor plate. Temporary cross strongbacks are welded in at 5-foot intervals to hold constant cross section. The sections of trough are then welded into single 60-foot lengths at dockside.

These sections are installed in the ship and temporarily blocked. After establishing location and straightness by optical methods, the sections are tack-welded into position. A carefully planned welding procedure is employed to make the troughs an integral part of the ship's structure. After welding, the temporary strongbacks are removed. When all welding is complete, variation from an optical line over 240 feet in length is a maximum of $\frac{3}{16}$ inch. This, in itself, is an outstanding example of com-

petent as well as efficient shipfitting.

Upper rails are made in 20-foot sections by burning scallops in 3-inch mild-steel plate. The rails are then trimmed and welded to the trough sides. Lower rails are a composite section of 4-inch channel and flat bar, *Fig.* 2. The flanges of the channel are trimmed to approximately follow the trough-side contour and then are welded into position. For shipfitting purposes, a scribed line is used for locations of upper and lower rails and cylinder stools. This proved to be more practical than optical methods for this particular operation.

The machining allowance was established as ¼ inch, plus or minus ⅛ inch. This proved to be a reasonable figure for this type of work. In certain localized areas, however, as much as ⅝ inch of metal is removed during machining.

Optical Tooling: Basis of accurate machining and support-bar location was adherence to two optical sight lines. The equipment utilized for this work involves Kueffel and Esser jig alignment telescopes, targets, autoreflection mirrors and other related optical accessories. Adherence to the optical lines is insured by tooling clips located at 6-foot spacing in the trough. These clips, 1½ by 4 by 18 plate welded to sides of the trough, *Fig.* 3, are used for all machining and aligning operations.

An optical sighting plate, *Figs.* 4 and 5, is located and dowelled in the trough at each end. Their location was by scale measurement, with squareness by autoreflection. Telescopes are located in aftermost plate, and glass tooling targets in forward plate. Optical observations are made at 30-foot intervals along the trough, night and day, over a five-day period, using a vernier against upper rails and stools. These observations confirmed the best time of day for optical work, which is between 9 p.m. and 6 a.m. During these hours, very little ship movement is evident, either horizontal or vertical.

Then, a special jig, *Fig.* 6, is bolted to a set of tooling clips at each 30-foot interval. The jig, squared to lines-of-sight by autoreflection, is brought exactly into line-of-sight by jackscrews. The jig is then tightened and rechecked. One-inch holes are reamed, and 1⅝ counterbores are made in each tooling clip, *Fig.* 3. All tooling clips are machined in a similar manner between the 30-foot basic increments. Actually, this tool clip operation determines final alignment for all subsequent operations. Therefore, it is done with great care and accuracy. About five sets of two clips each can be reamed in an eight-

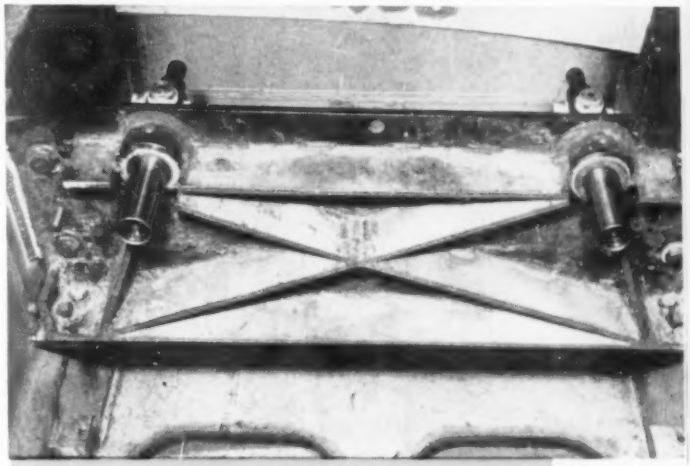
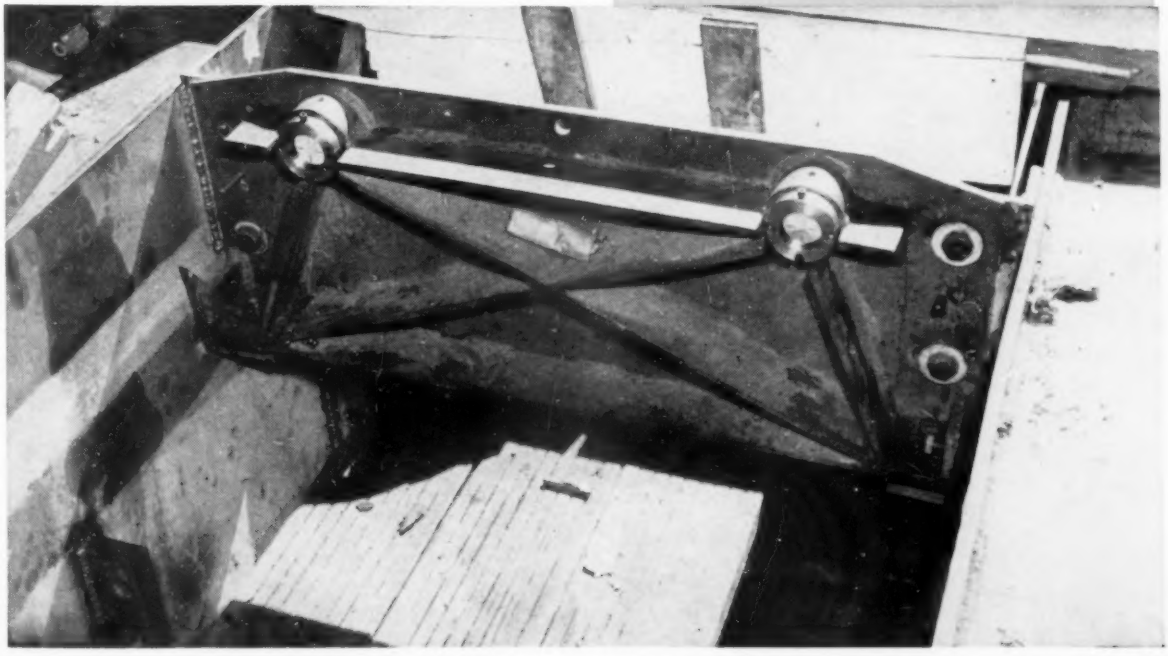


Fig. 4. (below) Forward optical sighting plate showing glass tooling targets.

Fig. 5. (right) Aft optical sighting plate showing jig alignment telescopes.



hour shift under normal conditions.

As a constant means of checking accuracy, two holes are bored in all machining and aligning equipment, which are coincident with optical sightlines. Holes are bored to accept telescopes, tooling targets, or autoreflection mirrors. The random optical checks made during machining showed minor deviations on the order of 0.010 inch. This confirmed that the tooling clip method of locating is sound.

Portable Milling Machine: The milling machine for surfacing the side rails and cylinder stools was designed especially for the job. However, practically all components are reusable. The machine, shown in *Fig.* 7, can be briefly described as follows:

Five supports at 6-foot spacing are bolted and shoulder-dowelled to tooling clips in the trough. These supports carry two 7½-inch OD by 6.1-inch ID tubes (scrapped submarine radar mast). Located on the tubes is a carriage, which in turn carries three milling heads. The feed is by means of a 3-inch diameter feed screw and bronze nut driven by a 40.5 to 1 worm drive and powered by a 5-hp hydraulic motor. The entire feed unit locates on any tube support by means of a T-slot arrangement.

The milling heads are driven through a 14 to 1 bevel-planetary gearing by 7½-hp hydraulic motors which were borrowed from gun mounts. The milling spindles are carried on steep-angle Timken bearings, and are extremely sturdy. The side milling cutters are 22 inches in diameter and carry up to twelve tools. The lower milling cutter is 34 inches in diameter and carries up to 24 tools.

With tube supports on 6-foot spacing, the machine carriage can travel about 47 inches before the support directly in its path must be removed. An auxiliary portable tube support is installed directly behind the mill head carriage before the tube support in front of the carriage is removed. Thus, supports are removed and replaced in progressive fashion as machining advances along the trough. After each 18 feet of travel, as the mill head carriage approaches the end of support tubes, it is necessary to slide the tubes through the supports and mill head carriage for a new setup. This is done with small hoists.

The side and lower cutters turn at 115 rpm. This is maximum speed obtainable. Tool bits are ⅝ inch square with carbide inserts, grade 78B, ground with 7-deg negative rake. Cutting speed for side cutters

Fig. 6. Jig for drilling, reaming and counterboring tooling clips showing glass targets.

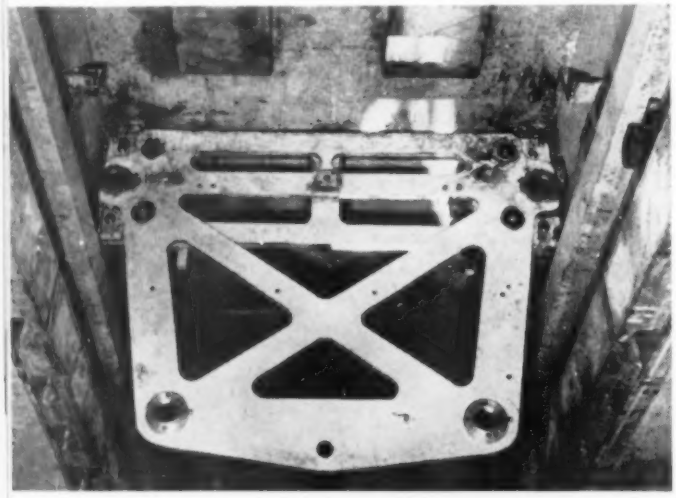


Fig. 7. Milling machine before installation in catapult trough.

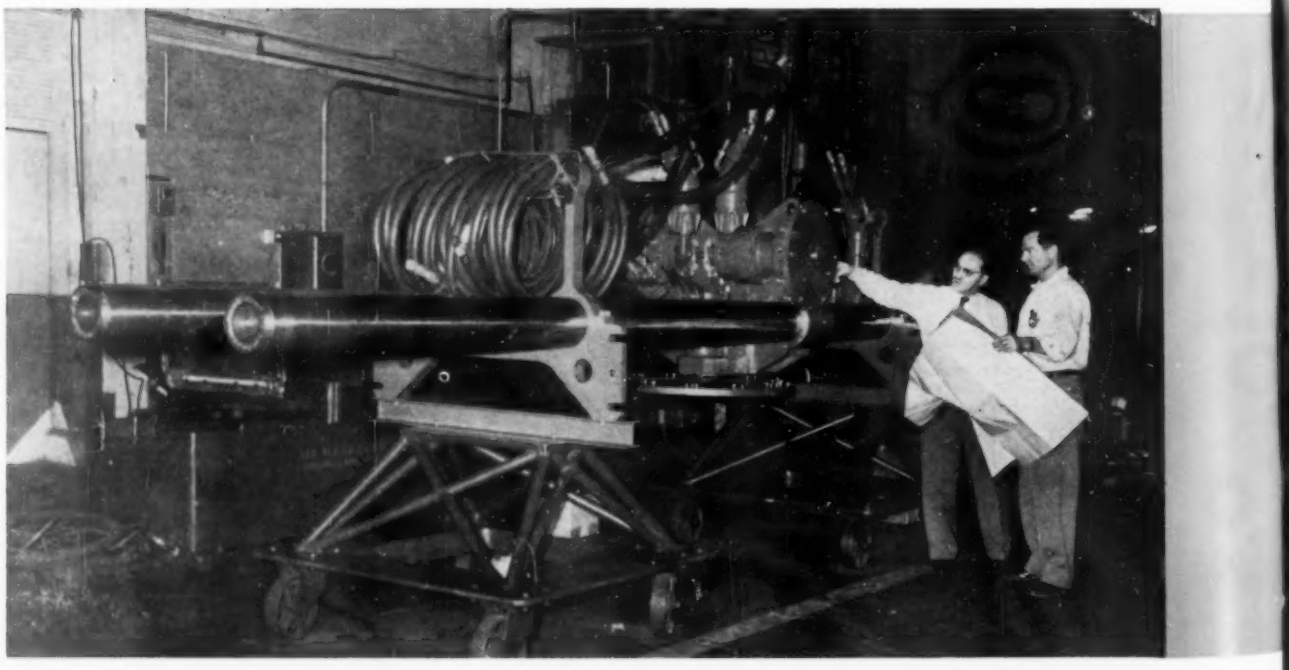
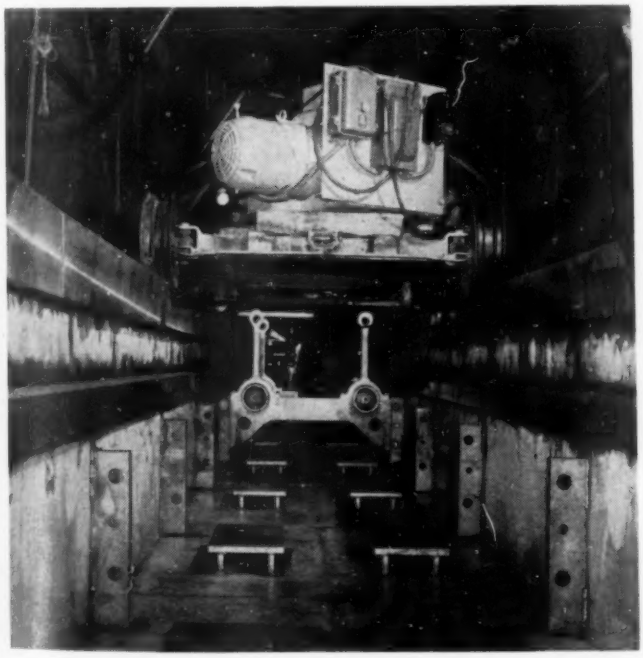


Fig. 8. Triple-head milling machine in use in catapult trough.

is 600 fpm, and for lower cutter is 960 fpm. Generated heat is carried away with the blue chips. Both tool and work remain relatively cool. Average feed rate is 2 inches per minute, although feed rates up to 4 inches per minute are employed occasionally. Average travel between tool sharpenings is 12 feet of milled surface. Tight control is maintained on tool grinding and setting, and is a great aid in maintaining accuracy.

The machine operates smoothly with little vibration, *Fig.* 8, and is able to remove up to 8½ pounds (30 cubic inches) of steel per minute. In the past, these rates were unheard of on a portable job. Few inside machine processes of equivalent power exceed this rate of metal removal. It is believed that this is the first portable job to employ negative-rake carbide tools successfully on an interrupted cut.

Fig. 9. View of trough after finish machining of rail supports and stools.



Ability to maintain accuracy and dimensions of the finish cut is built into the machine. Mill heads are positioned against solid ground stops and can not be overfed into the work. Tools are held in special holders and set by the toolroom grinding department to a predetermined dimension. Thus, accuracy and general trough geometry are insured. Micrometer measurements, made directly after machining, show a maximum variation of ± 0.003 of the 47.500-inch dimension. An optical check shows the trough to be straight within 0.030 inch in 60 feet, nonaccumulative. The actual machining time for the port trough was 17½ days, using two eight-hour shifts, or 280 hours actual total elapsed time. This includes all down time for new setups and tool changes. A portion of the finish machined trough is shown in *Fig.* 9.

Drilling Operations: The next operation is that of aligning the upper and lower support bars and of drilling nearly 4000 holes in each trough. All but about 800 of these holes are tapped for securing upper and lower support bars and cylinder stool facing plates. Concurrent with drilling, the locations of the upper and lower support bars are set. The location of upper support is critical because it determines the ultimate alignment and fairness of the shuttle track. Alignment of the support bars is insured by the use of fixtures, *Fig.* 10, which locate on a set of guide tubes, duplicates of those used for milling. Tubes, in turn, are held in supports which

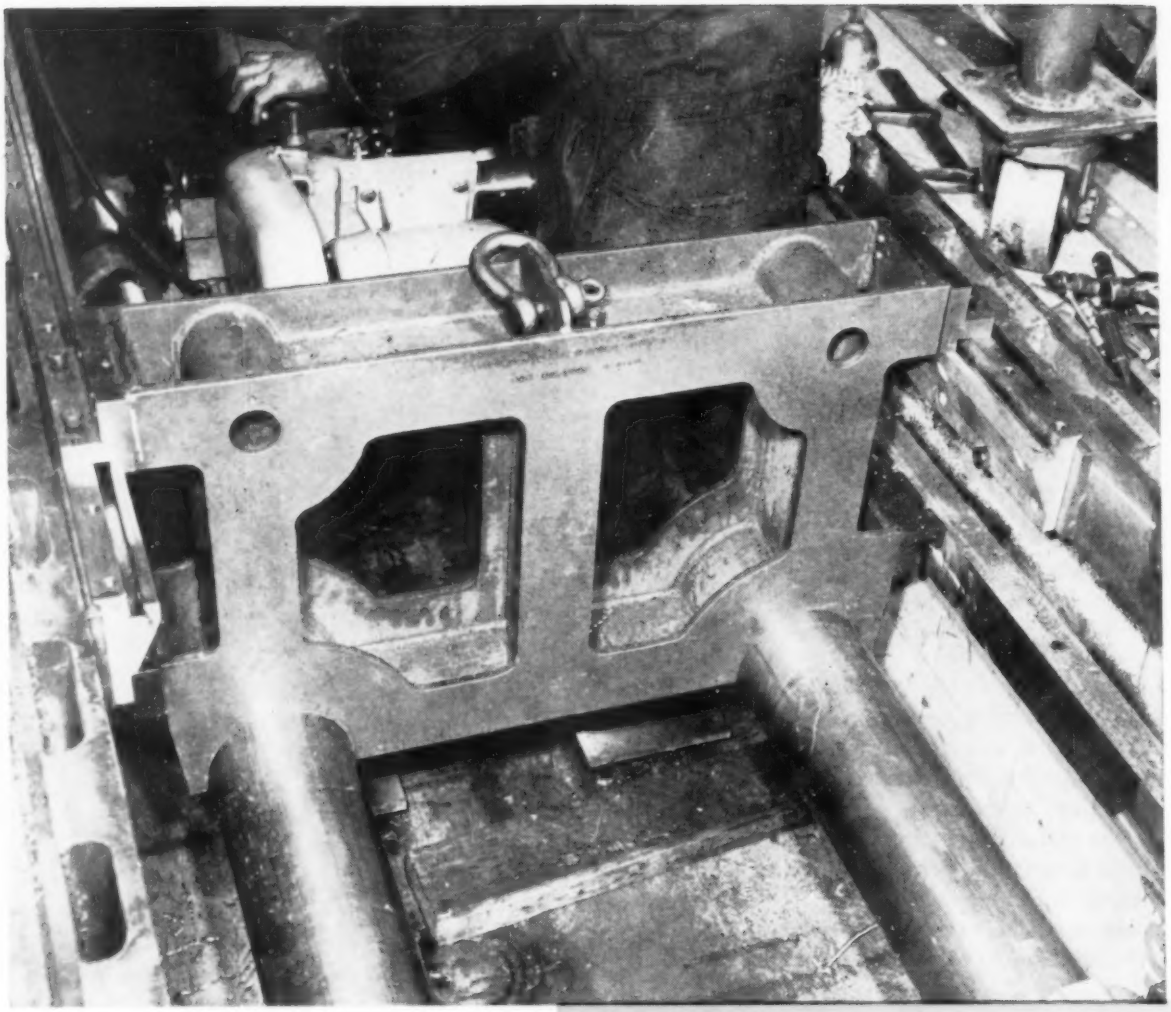


Fig. 10. (above) Support bar aligning and holding fixture in use during drilling.

Fig. 11. (left) Second operation drilling equipment shown reaming hole for fitted capscrew.

locate on the reamed holes in tooling clips. In effect, this procedure uses the same reference holes throughout machining and drilling. It was this method that helped insure the excellent alignment obtained.

No fitting of chocks is required, as the finished machine job is essentially straight and of correct geometry. The chocks which are used serve only as spacers and are all ground parallel and to the same thickness. In future work of this type, they will be eliminated.

The equipment selected for the drilling operations is a versatile, highly adjustable unit known as the Magna Drill. Although lightly constructed and low-powered (for outside machine use), the ease of handling, portability and features of power feed, automatic return, and leadscrew tapping prove to

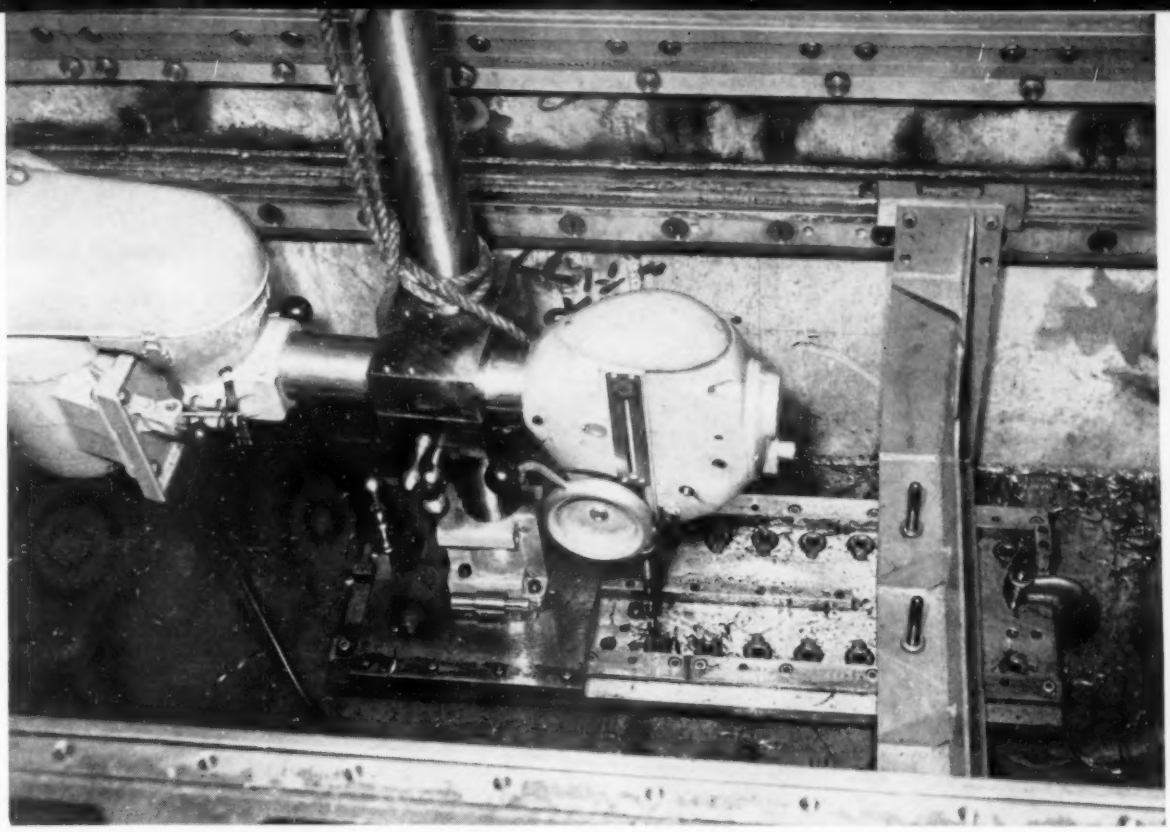


Fig. 12. Third operation drilling equipment in place, showing lightweight aligning fixture.

be of great value. The first operation drilling equipment, *Fig.* 1, is attached to a carriage which in turn guides on the same tubes locating the support-bar fixture. The sole purpose of the first operation equipment is to drill, ream, and tap at least three of the fitted capscrew holes in the upper support bar. This, of course, sustains upper support bar alignment. Support tubes are then removed, leaving locating fixtures hanging on the upper support bars. The second operation drilling equipment, *Fig.* 11, then drills the remaining holes in the upper support bar. It was necessary to utilize air drills to drill a $^{15}/_{16}$-inch hole through the trough in the way of the lower suport bar because of armor plate material.

The stools are drilled and tapped with the equipment shown in *Fig.* 12, which contains its own drill jig. Drilling and power tapping of the $^{3}/_{4}$-inch holes is done at 380 rpm with excellent results. Squareness alignment is insured by the light aluminum fixture shown.

The actual time required to locate bars and drill the port catapult trough was 12 days, running three shifts. This was excellent time for a project of this magnitiude.

Summary

Portable machining is not restricted to shipyard use. It has applications in many areas where large parts are involved and where portage and setups are a problem. Optical methods for setup and checking are excellent and go hand-in-hand with the "tooling clip" method and, in general, the whole concept of portable tooling. It is hoped that this discussion may provoke thought toward extending the use of this type of tooling in areas where time and money can be saved by its use.

The conclusions reached after the successful completion of the project were that:

1. Machining this type of job in place is the most practical and accurate method and insures the best alignment if tools are properly designed and used.
2. The tooling clip concept and proper use of optical equipment is a sound method and serves as a constant reference for all machining and aligning operations.
3. Metal removal rate for portable methods can nearly equal inside machine processes if tooling is properly designed.
4. Negative rake carbide tools are practical on a portable job and for intermittent cutting.
5. Inbuilt accuracy in portable tooling results in finished accuracy and elimination of fitted chocks.
6. The success of this operation opens a new field. Redesign of portable tooling will make it possible to improve ship construction, with the object of eliminating many machined sub-beds and fitted chocks.
7. Tool engineering pays dividends.

The success of this project indicates that portable tooling, in general, can be greatly improved. It has been apparent that this field has suffered an almost complete lack of engineering emphasis to its own detriment. If this article serves to stimulate engineering thinking, with an aim to the improvements that are possible and necessary in this type of tooling and application, it has amply served its purpose.

designed for

PRODUCTION

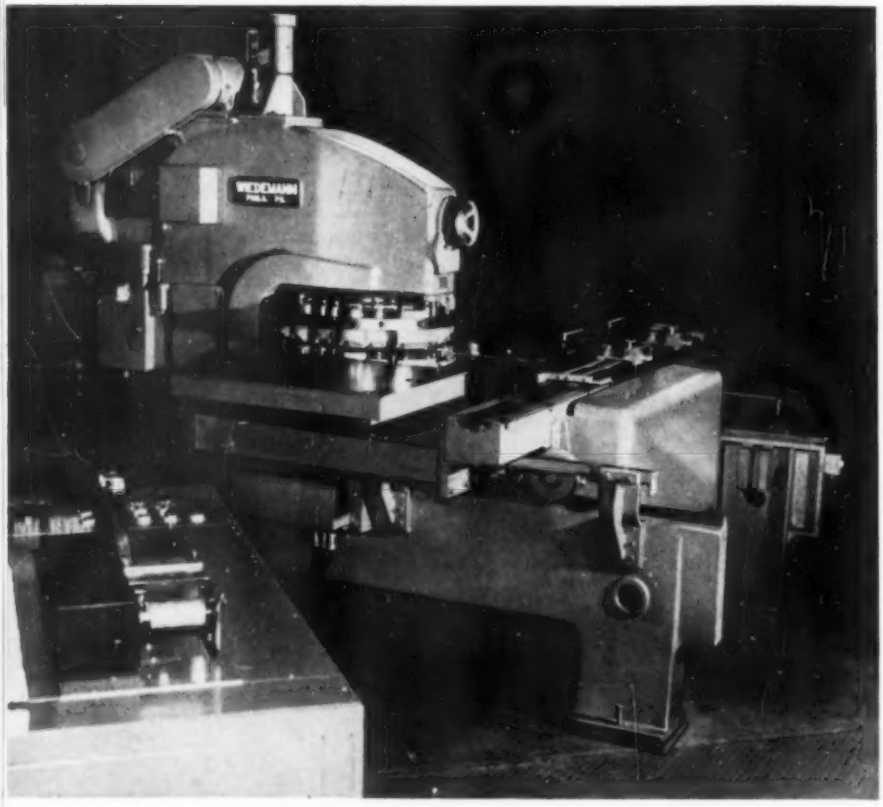
Automatic Turret Punch Press

Reduces Piercing Time and Cost

Combining principles of low cost, versatile tooling, minimum setup and no layout, with automatic controls to reduce piercing time, lessen fatigue and assure uniform accuracy, the automatic turret punch press developed by Wiedemann Machine Co., Philadelphia, Pa., permits efficient production scheduling. The illustrated machine has a punching capacity of 40 tons and throat depth of 33 inches. Wiedemann turret presses with direct measuring table and gage can be tape programmed.

With the automatic press, complicated hole patterns, including openings of many sizes and shapes, are located and punched in large steel sheets with great speed. The operator merely loads the material and unloads the finished work.

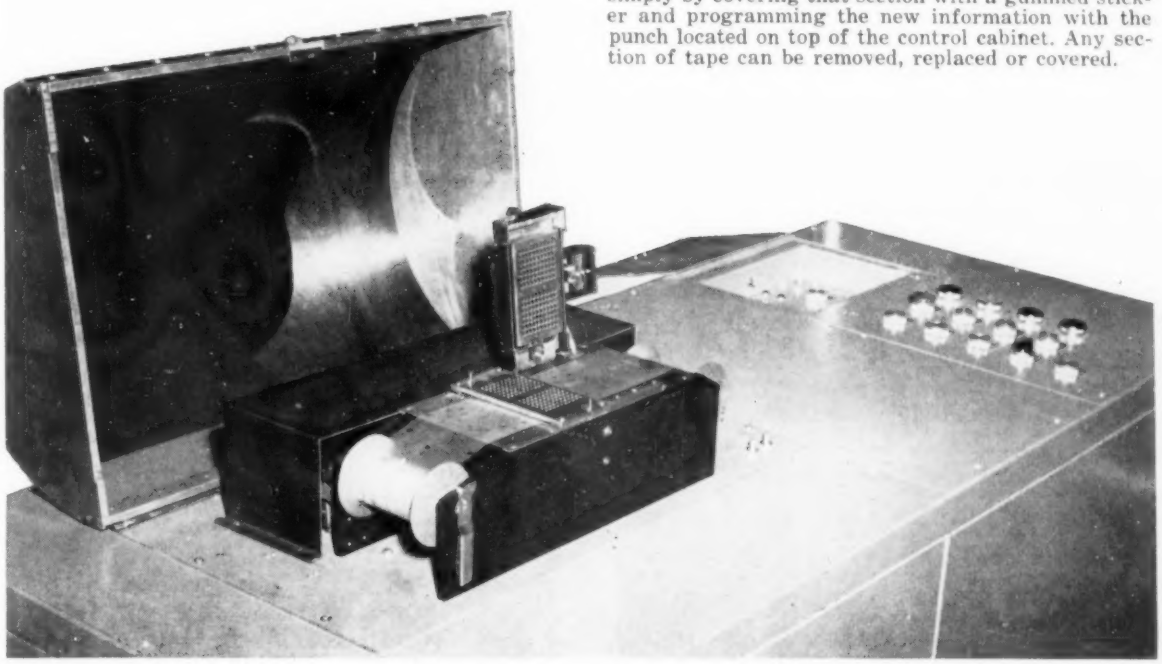
Because jobs can be processed on a predictable schedule with low fatigue, production per shift is increased and parts are ready when needed. In-process parts inventory can be reduced because steel sheets can be pierced when required.



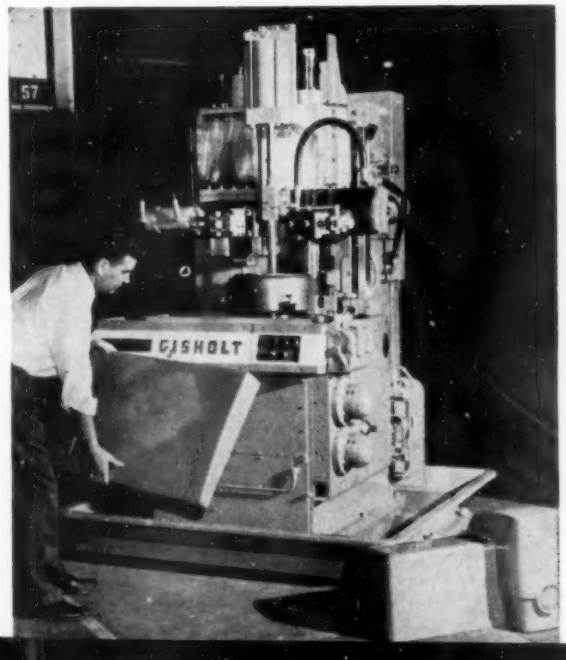
PRESS AND WORK locating table are controlled by a tape fed, electromechanical programming unit to automatically perform all functions—simultaneously positioning work under punch, selecting turret station carrying proper punch and die (any one of 20 up to 6 inches square) and tripping the press. This cycle is automatically repeated in rapid sequence until all holes are accurately located and punched. Any punch or die is brought into piercing position automatically during the work locating cycle without loss of time. Turrets are locked during piercing to assure alignment.

CLOSE-UP of the electromechanical programming unit that controls the functions of the turret punch press. Setup is reduced to placing the desired tape in the programmer and loading material on the table. Material is positioned by the operator to mechanical zeroing stops and clamped in a matter of seconds. Special vinyl tape, which is not affected by shop oils or greases, avoids the need for shop drawings, templates or time-consuming manual layout of each hole. Once prepared, the tape can be used and filed without fear of losing any of the job information.

Engineering changes can be made at negligible cost. The location or size of any hole may be changed simply by covering that section with a gummed sticker and programming the new information with the punch located on top of the control cabinet. Any section of tape can be removed, replaced or covered.



Lightweight Plastic Housings Reduce Production and Repair Costs



Housings for machine tools can be made of reinforced plastic and produced with plastic tooling with large cost savings. Such housings can be made for 20 to 40 percent less than sheet or cast steel housings, 20 to 35 percent less than cast iron and 30 to 35 percent less than cast aluminum. The lightweight housings also save time and expense during maintenance and repair of heavy machine tools.

REINFORCED PLASTIC housing panels are simply buttoned in place without need for bolts or hinges. Many pieces that would require use of a chain hoist during assembly and maintenance if they were made of metal can be handled easily by hand when fabricated of plastics. Down time can be reduced because of this handling ease.

DESIGNED FOR PRODUCTION

At the Gisholt Machine Co., Madison, Wisc., where the method was developed, production molds and fixtures are made of epoxy tooling resins. Bakelite polyester resins, combined with fiberglass cloth, are used to produce the housings. Plastic parts can result in weight savings without sacrifice of strength or utility.

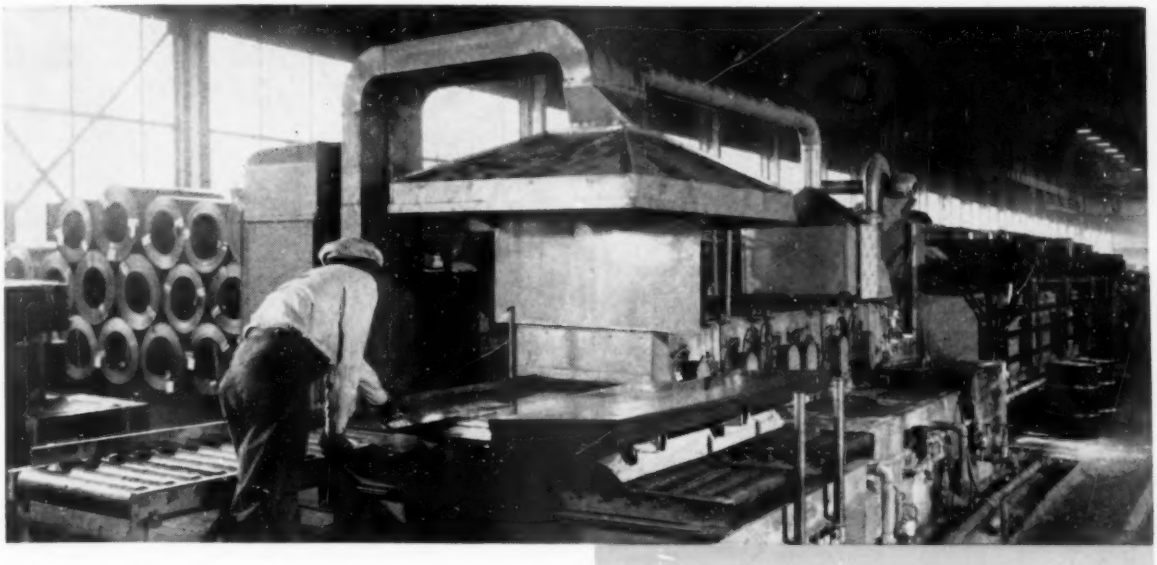
A 10-lb reinforced plastic machine tool housing, for example, costs between $8 and $9, depending on the size and complexity of the piece. In cast iron, the same piece would weigh between 80 and 100 lb, and would cost about $12.80 as a raw casting before machining, tapping, drilling and other clean-up operations. Plastic parts require little finishing because they come from the molds with a good finish. Also, molds can double as tools to position the parts during routing and trimming, thus saving the cost of tools and fixtures that would be required during finishing of metal housing parts.

FIVE REINFORCED plastic panels for a vertical automatic lathe have a total weight of 37 lb. They would weigh about 300 lb in cast iron or 120 lb in aluminum. These panels come from the mold with finished surfaces that require no machining, sanding, chipping or grinding. Reinforced polyester parts are resistant to abrasion from flying metal chips and shavings. Grease, oil, moisture and most solvents used in the metalworking industry have little or no effect on such plastic parts.

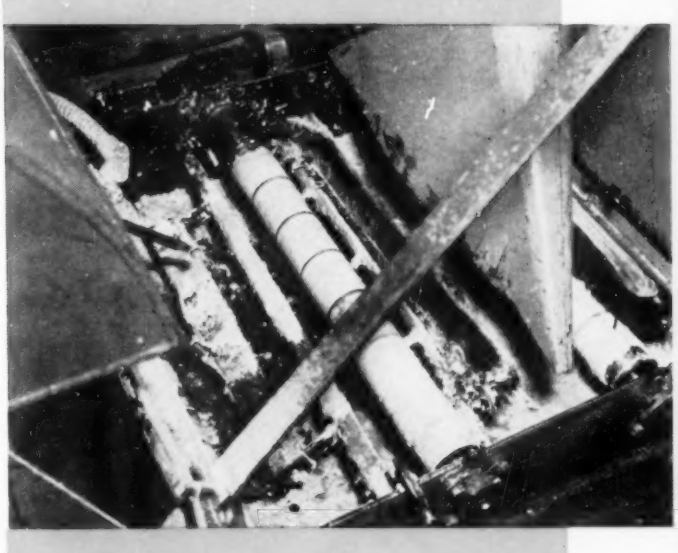
COATED STOCK deep drawn easily

Deep drawing of heavy gage stock, 0.250 inch, involves two important problems; easy movement of the stock under pressure, and wear and scoring on the dies. Equipment installed at Chevrolet Motor Div., General Motors Corp., Cleveland, Ohio, attempts to solve both of these problems by applying a coating to the metal surface prior to the drawing operation.

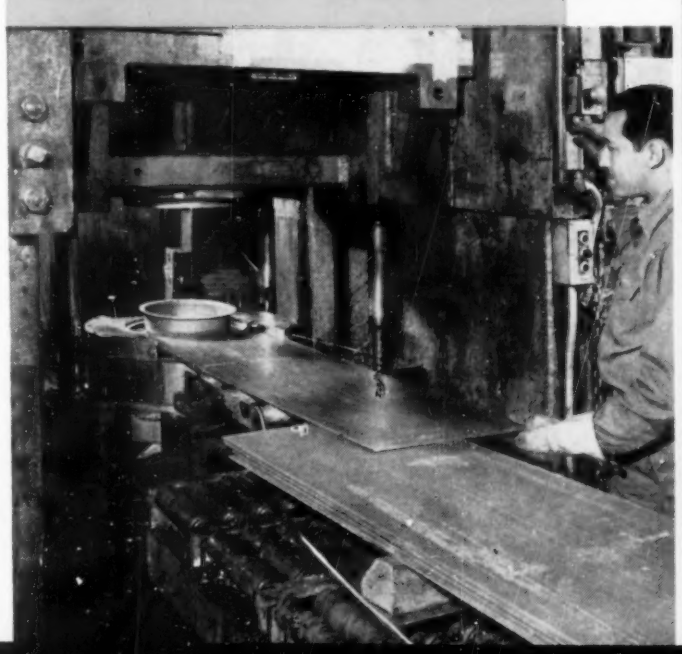
Consisting of a washer, an applicator and a drying oven, backed up by a stacker, the one-man operation keeps presses supplied with precoated heavy gage stock which can be banked in strapped bundles ahead of the press and fed to it as needed.



IN OPERATION, bundles of precut stock are positioned at the feed end by a crane. Strips are fed one by one into the powered-brush washer, where a live-roller conveyor carries them through a cycle of hot alkali and water cleaning solution, and hot water rinse at a rate of approximately 55 fpm. Steam from the washer is conducted to a cold water condenser where water vapors are removed from the air for recirculation.

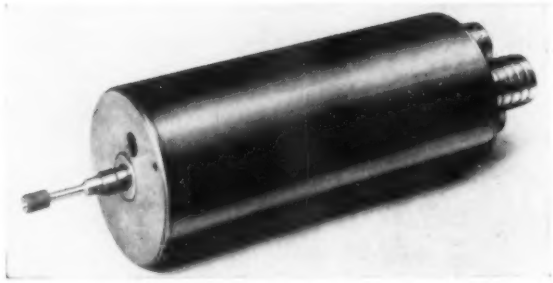


LEAVING THE WASHER, the strips are sprayed with a solution of hot coating material. They then pass between rollers, hot air blast and brushes to assure a thin, even coating. Continuing on the roller conveyor, the strips pass through a 35-foot infrared oven and emerge dry. A stacker is located at the discharge end of the oven and is so arranged with guides, stops and side walls that the stock drops from the conveyor into a stack ready for banding.

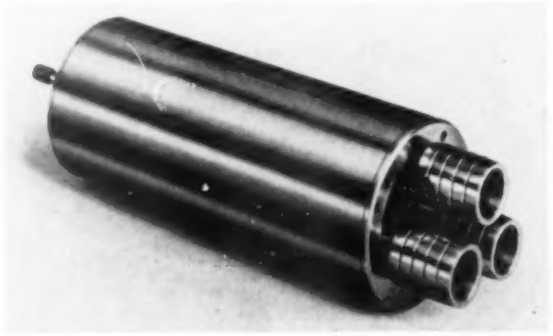


ADOPTION of precoated stock has resulted in greater die life and a reduction in scrap loss due to splits and tears. Precoated stock is deep drawn for such use as automatic transmission converter housings.

High-Speed Contact Roller Spindle Grinds Small Holes at Correct Speed



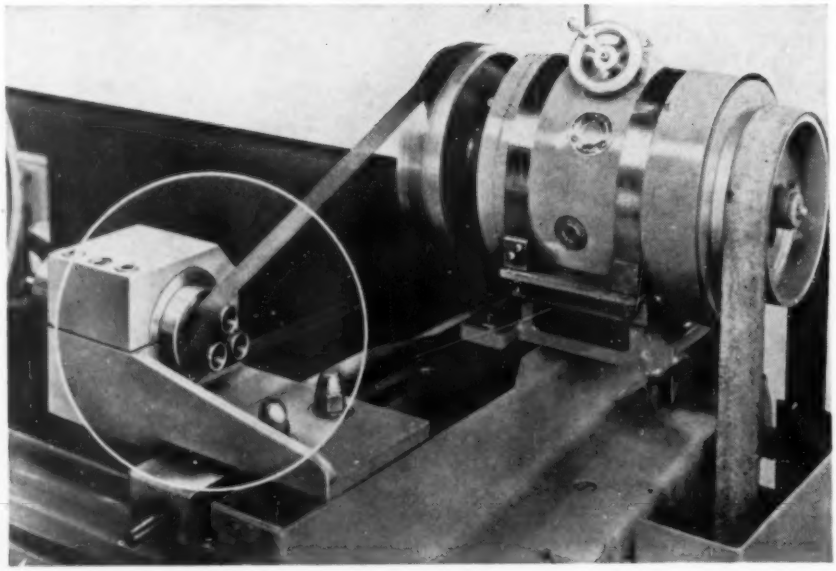
DIAMOND STUDDED PINS are used for grinding 1/32-inch holes. A wide choice of abrasives is possible for larger holes. Currently, special mounted points with threaded arbors must be used. Standard commercial collets have insufficient concentricity to operate at 200,000 rpm although the feasibility of designing a straight-shank holding collet with sufficient concentricity is being investigated.



Problems of grinding holes as small as 1/32 inch focus on achieving correct surface speed for the abrasive medium. High-speed rotation is necessary because mounted point diameters are small. Bearing mounted spindles cannot operate at the required speeds because the bearings would be overstressed. This internal grinding spindle, developed by Ferd. Wagner, Pforzheim, Germany (Columbia International Corp., Long Island City, N. Y.), does not operate in bearings and can achieve a speed of 200,000 rpm.

The disk wheels of the driving spindles, which hold the working spindle, have a secondary function. Since the disks of two of the driving spindles dip into an oil bath, and because they operate at high speed, the oil is atomized and lubricates the entire contact roller spindle unit.

OPERATING PRINCIPLE of the high-speed spindle is simple. Three driving spindles, each mounted in four precision ball bearings, are driven by the pulleys at speeds up to 50,000 rpm, well within the speed range of the bearings. Series of disk wheels on each of these spindles have roller contact with the centrally positioned working spindle. Disk wheels have diameters four times that of the working spindle to give a speed multiplication of four.



MOUNTED ON a standard universal cylindrical grinder, the contact roller spindle unit uses mounted points to grind small holes at correct surface speeds. A fractional horsepower motor turns the driving spindles through a flat nylon belt that contacts the three driving-spindle pulleys. Speed of spindles can be changed by using a variable-speed motor or drive, or by changing the motor pulley size. A 10-inch motor pulley, for example, gives a speed of 180,000 rpm with a 3600-rpm motor. This high-speed spindle can be used on grinders or lathes.

how to apply

CARBIDE TOOLING

to automatics

By E. J. Weller
Carboloy Dept.
General Electric Co.
Detroit 32, Mich.

Mr. Weller joined the Carboloy Dept. of General Electric Co. as a carbide and design application engineer early in 1954. He began his career with General Electric Co. in 1937, as an apprentice machinist in the Turbine Division. Upon completing the company's apprentice training course, he became a die maker. Later, he was transferred to the materials and process laboratory. At present, he is manager of carbide products design engineering.

Mr. Weller is an author of several articles on development of improved tool designs and machining practices. He is on the metal-cutting committee of ASME and the subcommittee on cemented carbides of ASTM.

SUCCESSFUL APPLICATION of carbides to multiple bar automatic machines requires attention to details: those involving the machine, part and tool design; those leading to close control of tools and materials processed; and those involving good machine and equipment maintenance. The effectiveness of handling these details determines the dollar volume of parts produced for each dollar spent for materials, tools, machines, floor space and labor.

The most successfully produced parts are those which are designed with due consideration given to materials for parts and tools, manufacturing and inspection methods, machine tools and personnel available. Any part machined develops costs commensurate with the labor involved in converting raw material into finished products. One of the most expensive items involved in machining is converting material to chips. Usually, the smaller the volume of chips produced, the lower the cost. This trend reverses, however, as volume of material to be removed becomes very small, particularly when tolerances become closer also.

The cutting tool is only as good as the machine tool allows it to be. Carbides are rigid themselves and require rigidity in machines, tool and work holders, and workpieces to show to best advantage. While carbides are capable of doing more work per minute than any other commonly used cutting material, to exploit this capability more power must be made available for cutting. Power and its utilization, however, must be adequately controlled.

Multiple bar automatics, built with an eye toward the use of carbide cutting tools, must provide for the capabilities and requirements of the tool material. For example, machine spindles require ample bearings adjusted to minimum levels of play. Slide operating tools and attachments cannot be allowed play or looseness. Collets and other work-holding

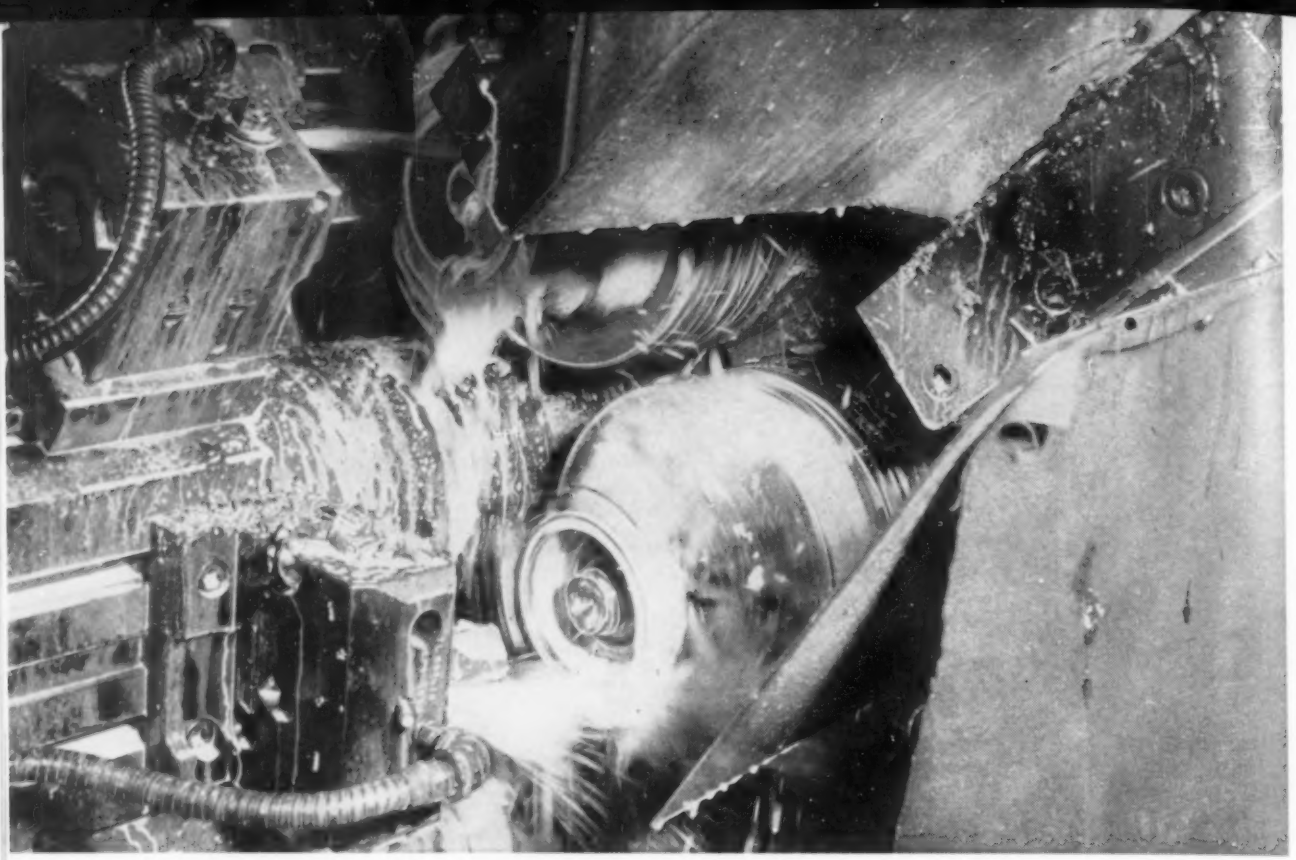


Fig. 1. Cutting fluid piping is located to follow carbide tools in this 6-spindle chucking machine. Operation is turning, facing, chamfering and drilling transmission clutch hubs in Packard's new Utica, Mich. plant.

devices must be sturdy enough to position the work positively and maintain it while work is in progress. They must also be capable of fast action in loading and unloading.

Cams must operate without hesitation or lost motion, and with minimum dwell time. Excessive backlash in gearing means premature tool failure. Horsepower of the motor must be transmitted smoothly and with the greatest possible efficiency to the working area. Seals which segregate cutting fluids and lubricating materials properly are desirable. Efficiency of a cutting fluid contaminated with lubricating materials may be impaired. Cutting fluid, when allowed to enter bearings, may reduce bearing life.

Pumps and piping supplying cutting fluids should be of ample capacity, *Fig.* 1. An intermittent or inadequate supply of cutting fluid may often do more harm than good. Alternate heating and cooling sets up stresses which often results in chipped or cracked tools. A machine built or adjusted to close operating tolerances when cold must be maintained at or near that temperature to prevent seizure of bearings. Adequate provision for removal of chips, supply of stock and rapid positive tool changes must be made as illustrated in *Fig.* 2.

Tolerances determined for dimension and finish can spell the difference between profit and loss. Function and appearance dictate extreme limits of tolerance. Tolerances specified on drawings should be established within the extremes. The effect of material selected, manufacturing method used, equipment available, such as machines, cutting tools, inspection and handling equipment, should be carefully considered as well as capacity of personnel—supervisory, planning and methods engineers, setup men, machine operators and inspectors.

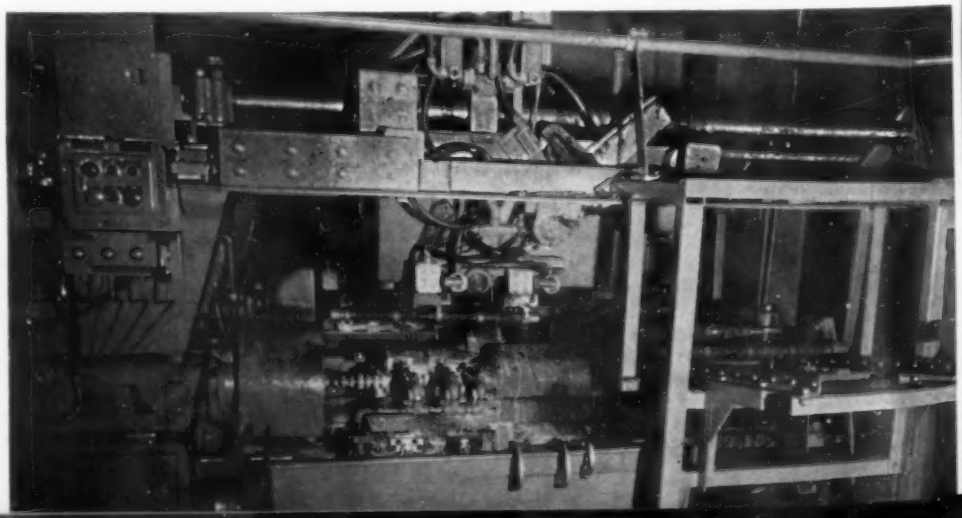


Fig. 2. Stock supply, cutting fluid and chip removal are well handled in this twin setup for machining camshafts in Packard's Utica plant. Automatic carriers load and unload the side-by-side machines, processing about 50 cast steel workpieces per hour.

Tolerances on surface finish are probably the most troublesome to specify, inspect and maintain. This is mainly due to lack of experience in measuring, defining and in determining the effect of surface finish. In general, a multiple bar automatic uses tools which readily produce surface roughness in a range of 125 to 250 microinches. This range is also within that usually found on cold drawn or centerless ground stock. Turning tools, form tools and drills produce a finish near 250 microinches rms.

Where finishes better than 125 microinches rms are required, special care, tools and materials may be involved. To produce a finish of 60 microinches rms or smoother, extra operations such as burnishing are usually necessary. If part requirements dictate and costs warrant, finer finishes often can be obtained on parts produced on an automatic. It may be more profitable, however, to produce a fine finish on parts by secondary operations such as tumbling or brushing. In all cases it is wise to specify the roughest usable finish to minimize costs.

Dimensional tolerances are worthy of as close consideration as that given the dimensions to which they apply. Diameters are more easily maintained to close tolerances than lengths. Concentricity and other relationships of dimensions are easiest to maintain when related dimensions are produced in one position.

Tool design also has a considerable effect on the tolerances obtained on an automatic. On tools, such as form and cutoff, it is often difficult to obtain satisfactory clearances, which result in free cuts. Properly designed tools clear the work and may be reground without losing size or contour. Lack of free cutting action results in generation of extra heat, rapid tool wear and imposes loads on the tool and work, which deflects both from their positions.

Tolerances listed in TABLES 1, 2 and 3 should normally be obtainable. These are desirable from the standpoint of a multiple-bar automatic. Closer tolerances may be obtained but usually involve extra costs.

General design considerations for parts to be produced on an automatic are similar to those for many other machining operations. They are listed below:

1. Part and tool design should be such that tools travel the shortest possible distance.
2. Surfaces to be machined must be accessible for approach and retraction of tools, application of cutting fluids and ejection of chips.
3. A tool should, if possible, travel in only one direction.
4. Ratios of length to diameter of parts and cuts should be low for maximum rigidity and shortest production time.
5. Threads, forms, holes, etc. should have areas provided for starting and finishing, so cutting loads will be applied and released gradually to avoid impact on starting or when finishing an operation where a tool may strike a shoulder or the bottom of a hole. In particular, clearance must be provided to avoid bottoming a tap or reamer and for imperfect threads when tapping or chasing threads.

Fig. 3 illustrates design features for some of the five points above.

Hand in hand with part design goes material and stock selection. Although service requirements of the part dictate minimum physical and chemical requirements of the material, there are usually several stock materials available which meet the requirements. In turn, those materials which meet the minimums may be obtained in many forms and surface conditions. The most economical material is selected by considering the following:

1. Availability of materials—both present and foreseeable future.
2. Costs of various available stock types and forms.
3. Conditions of materials available.
   (a) Hot rolled: Usually cheapest per pound, but scale, decarburization, difficulty in obtaining fine finish, etc. may result in higher part cost.
   (b) Cold drawn: May improve tool life due to lack of scale, improved finish on parts and better chip formation.
   (c) Centerless ground: Lack of scale and decarburization help improve tool life.
   (d) Straightness: At the speeds which may be used with carbides, unbalance due to distorted material may cause tool chipping or premature failure of the tool and undue wear on the machine and attachments. In addition, noise of rattling of stock in tubes may be objectionable.
   (e) Lengths of available material: Lack of consideration for multiple lengths may increase cost.
   (f) Microstructure: Depending on operating and processing requirements of the part, microstructure is often varied. The best microstructure from the standpoint of physicals is not necessarily that structure which will yield optimum tool life and surface finish.

Table 1—General Tolerances on Diameter and Length

Tools	Diametrical Tolerances (inch)
Boring and turning tools applied from the end tool slide	± 0.0035
Roller turners	± 0.002
Cross slide tools with positive stops	± 0.002
Reamers, floating: holes up to ½ inch	± 0.005
up to 1 inch	± 0.001
up to 1½ inch	± 0.0015

Dimension Description	Longitudinal Tolerances (inch)
For over-all length	± 0.010
For shoulders facing same direction produced by one tool or multiple tools "ganged" in same position	± 0.002
Where two or more positions are involved	± 0.004
For shoulders opposing each other produced by one tool or multiple tools "ganged" in same position	± 0.003
Ditto, involving two or more positions	± 0.005
Flatness of ends produced by cutoff tools maximum concave or convex	— 0.003
Flatness of ends produced by a facing tool maximum concave or convex	— 0.001

Table 2—Tolerances on Diameter of Drilled Holes

Diameter of Hole (inches) Over	To and Including	Variation from Basic Size (inches) Material A*	Material B†
	0.040	+0.002 −0.001	+0.001 −0.002
0.040	0.070	+0.003 −0.001	+0.001 −0.003
0.070	0.128	+0.004 −0.001	+0.001 −0.004
0.128	0.228	+0.005 −0.002	+0.002 −0.005
0.228 (¼)	0.43 (½)	+0.006 −0.002	+0.003 −0.006
0.500	0.750	+0.008 −0.002	+0.003 −0.008
0.750	1.00	+0.010 −0.003	+0.005 −0.010
1.00	2.00	+0.015 −0.003	+0.005 −0.015

*Materials such as steel in which holes as produced do not tend to shrink.
†Materials such as copper in which holes as produced tend to shrink.

(g) Uniformity of material: This is a major consideration since even materials difficult to machine are easier to handle if uniform in properties and dimensions.

4. Machining process.
5. Quantities of parts involved.
6. Tool material to be used.
7. Part requirements, including: contour, internal and external lengths, dimensions, magnitude, tolerances and finish.

Tool control is essential in effectively applying carbide tooling to automatics. In an automatic, each tool performs its function with virtually no opportunity for inspection as a cycle progresses. When a tool fails, care must be taken to determine the cause. Often, tool failure is directly traceable to another tool on the machine. Perhaps other tools have not performed their functions completely, or have brought about a condition on the workpiece such as work-hardening which contributed to the premature failure of the other tools in the setup.

Table 3—Tolerances on Eccentricity and Total Runout of Holes and Diameters

Description	Runout (inches) For holes and surfaces produced at one position.*	For holes and surfaces in relation to unmachined stock.†
Drilled holes (where L < 3D)	0.010	0.010
Bored holes	0.002	0.005
Drilled and reamed holes	0.003	0.010
Bored and reamed holes	0.001	0.005
Turned surfaces	0.001	0.005

*0.005 inch may be added for added positions.
†Special consideration must be given for excessive projection of stock from chuck or collet. Also, surface of stock (hot rolled, cold drawn, etc.) affects runout. These are for cold drawn or centerless ground stock.
Note: All relative dimensions should have a common reference for easier inspection of complete parts and setting of tools. When considering variant of holes and surfaces produced by different methods the tolerance for that method requiring the greatest tolerance shall govern.

Cutoff tools in particular are affected by the performance of other tools. When breakdown tools are used, the cutoff tool may be cutting on only one side part of the time. This condition tends to deflect the tool and may cause breakage. Also, the breakdown tool may produce a groove so narrow that the cutoff is cutting or rubbing while in rapid traverse, approaching the cut.

In some cases breakdown or roughing tools may work-harden surface layers of the work material. Again, this puts an increased burden on the following tools. For breaking down prior to cutting off, it is desirable to provide a slot slightly wider than the cutoff tool. This can be indicated in the design by

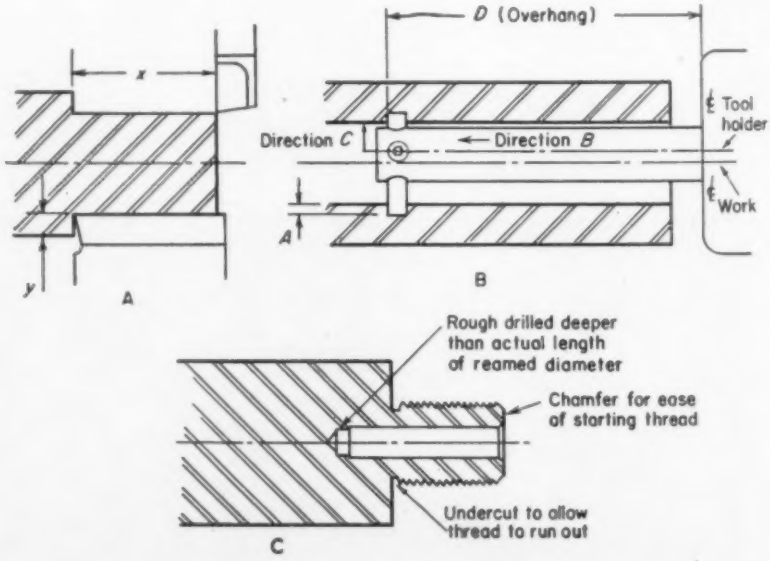


Fig. 3. Examples of problems of carbide tool design for automatics: *x*, in view A indicates long tool travel; *y*, short tool travel —preferred. Depth of groove at *A* in view B is difficult to get at, particularly with small bore diameters. Two-direction travel (*B-C*) results in longer time cycle, loss of rigidity; excessive overhang (*D*) is often standard procedure in a grooving tool. Starting and finishing area, view C, eliminates bottoming in threading and reaming.

Fig. 4. Setup fixtures employed in piston ring production for presetting carbide grooving tools in Packard's Utica plant.

a slight shoulder on the face of the part.

Tool dimensions must be controlled closely enough to permit presetting tools outside the machine, Fig. 4. This holds down time for tool changes at a minimum. To accomplish this, it may be necessary to hold the required dimensions on the tools and holders closer than those of the parts themselves.

The necessity for rigidity of toolholders and tools cannot be overstressed. Tools on an automatic are similar to punch press tools in that they are expected to perform a great many cycles without resetting or adjustment. Lack of rigidity results in deflections which may change with operating conditions. This makes maintenance of tolerances difficult. The magnitude of cutting forces has been measured by a number of investigators. This information should be considered in tool design. In general, the results reported indicate the major force component is directed perpendicular to the top surface of the tool.

Load, when machining a material such as SAE 1020, can be approximately calculated based on an approximate force of 500 pounds per thousandth square inch of chip area when the chip thickness is in the range of 0.002 to 0.005 inch. As chip thickness becomes less than 0.002 inch, the unit pressure per thousandth square inch of chip area increases considerably. As chip thickness increases above 0.005 inch, unit pressure per thousandth square inch of chip area decreases.

In view of this it follows that thicker chips may be removed more efficiently than thin chips. Nevertheless, on automatics as on any other machine, the limit of chip thickness is determined by a number of factors which must be considered. Some of these are:

1. Machine power available at the tool.
2. Tool rigidity and strength (tool design).
3. Length of cutting edge involved.
4. Part design.

Selection of cutting speeds and feeds must receive careful consideration when tooling an automatic. Except for some end-working tools such as drills, reamers, boring heads and thread chasers on which auxiliary spindles may be used, all tools are working at the same number of revolutions per minute. Since a number of diameters are usually involved, this means a variety of cutting speeds will be in operation at the same time.

Feeds and speeds are therefore selected with an eye toward obtaining the shortest possible machining cycle and as near equal tool life as possible for all tools involved in a machine setup, since this minimizes down time for tool changes. Another consideration is as equal as possible distribution of work at each work station to maintain full permissible load on each station.

Machinability ratings of a variety of materials and approximate values of power required to remove one cubic inch of material in one minute by drilling are listed in TABLE 4. Power for turning is usually about half that required in drilling. These are probably the two most common operations occurring on automatics. Machinability ratings may be used to determine cutting speed and feed for the materials listed as compared to the speeds and feeds shown for B1112 in *Figs.* 5 and 6. Multiplying the speed and feed for B1112 steel by the machinability rating for the material to be machined results in an approximate speed and feed. Usually, on automatics, a single-point carbide tool cutting AISI B1112 steel should be capable of giving approximately 60 minutes cutting life at approximately 800 fpm, $\frac{1}{16}$-inch depth of cut and 0.005-inch feed. *Figs.* 5 and 6 are based on these figures. The rate of feed shown in *Fig.* 5 falls off considerably with wide tools. It may not be necessary to decrease feed as rapidly if tool

Table 4—Machinability Ratings of Various Materials Based on Drilling Operation

Material	Machinability Rating (number)	Hardness Number (Brinell)	Power to Remove Unit Volume* (hp)
1010 HR	0.75	126	2.20†
1020	0.60	126	1.50†
1045	0.60	160	1.30
1095	0.40	225	3.00
1112	1.00	180	1.20
4140	0.45	255	2.50
302 SS	0.40	179	2.95
303 SS	0.80	160	1.75
416 SS	0.85	217	1.40
347 SS	0.25	180	3.40

*1 cu in. in 1 minute by drilling

†Horsepower requirements are high, possibly due to the "gummy" nature of this material.

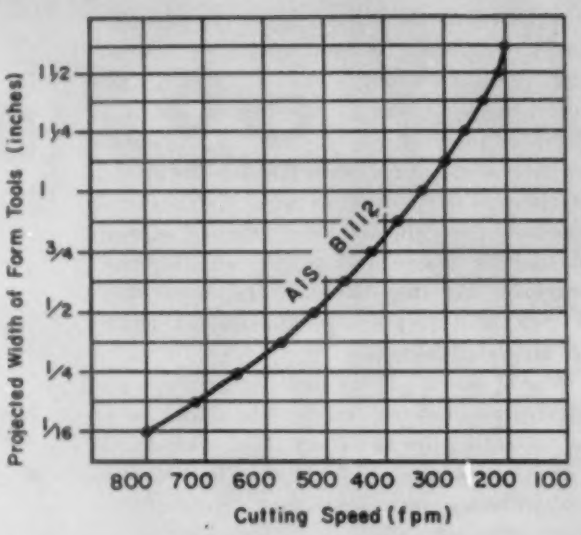


Fig. 5. Preferred cutting speeds for B1112 steel based on projected width of form tools.

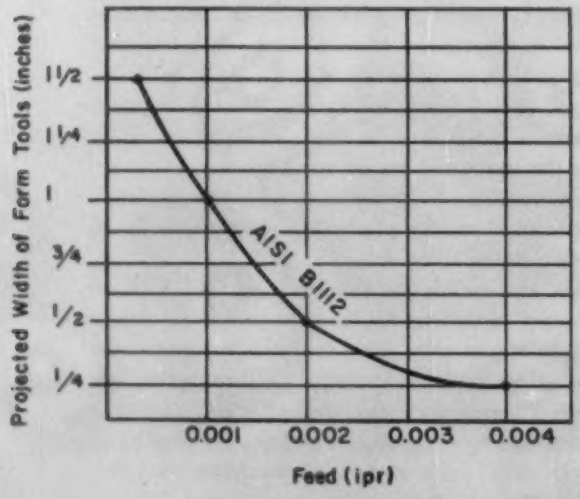


Fig. 6. Preferred feeds when cutting B1112 steel, based on projected width of form tools.

support can be increased and tool overhang decreased.

Cutting fluid and its application can, and often does, make the difference between success and failure in machining on an automatic. The correct cutting fluid properly applied will almost invariably increase tool life. The major functions of the cutting fluid are to decrease tool wear and chipping, aid in maintaining workpiece and machine temperature, improve ability to maintain tolerance and workpiece finish, decrease cutting load and remove chips.

Briefly, good cutting fluid application consists essentially of applying the correct material, properly mixed, at the right time and place with the required volume and pressure. Good placement and direction

Table 5—Elements for Setting up a Job Record for Automatic Screw Machines

1. Part number
2. Layout number
3. Machine size
4. Hourly production, gross
   (a) Hourly production which can be expected on an 8-hour run, considering down time, tool sharpening, etc.
5. Cost of initial tooling, gages
6. Cost of changes and rework
7. Cost of grinding wheels used in making initial tools
8. Cost of grinding wheels used in keeping tools sharp
9. Amount of tool breakage, etc. in getting the job in production
10. Tool life on each tool
11. Cost of carbide tools (per piece basis) including diamond wheels, grinding time, etc.
12. Setup time, or if 2 parts are involved, change-over time
13. Recommendations on tooling attachments, machine, etc. on future jobs.
14. Tooling arrangement
15. Feeds and speeds, horsepower required, coolant
16. Type of tools with tool drawing number
    (a) Method of holding tools
    (b) Grade of carbide
    (c) Brazed-on tools
    (d) Solid carbide (mechanically clamped)
    (e) Quantity of tools
    (f) Revisions
17. Anticipated date for tooling
18. Tooling changes (marked on drawings and tool list so all prints can be kept up to date)

of cutting fluid and nozzles will decrease the possibilities of chips winding around pipelines and hoses, pushing nozzles off location, and of chips blocking or deflecting the fluid stream. *Fig.* 1 illustrates a method where the cutting fluid piping is positively located on the machine to follow the tools.

An internal forming tool as originally designed and redesigned is shown in *Fig.* 7. In the original form, the tool chipped out due to intermittent supply of cutting fluid. The redesigned tool directed the cutting fluid to each cutting edge continuously. Chipping no longer occurred.

In setting up an automatic, location of cutting tools in relation to workpiece requires close attention. Often the setup for grinding a tool is such that a natural clearance is obtained when the tool is set in the automatic. In such cases it is easy to become confused as to the exact location and positioning of the tool in use. The fact that carbide has a stiffness approximately three times that of steel requires that tools be properly located. A less rigid tool will deflect, sometimes developing its own clearance. This is usually not the case with a carbide tool. A properly set tool will give excellent tool life and better parts. A poorly set tool may fail immediately.

It is necessary to make sure that each machine to be tooled with carbide is carefully checked to determine its condition. The inspection should start with the supply of power to the motor and progress through the motor, transmission, spindle drive, spindles, cams, slides and accessories, leaving nothing to chance.

Often it develops that the most obvious items require attention. Cutting fluid pumps and piping especially require checking to be sure they are delivering the required supplies of fluid to the tool.

As machine output is increased, material handling becomes an important item on an automatic. Chips will probably receive first attention because of their

nisance value. Equipment to remove chips automatically is often a necessity when a job is tooled with carbides. Adequate stocks of raw material, conveniently located, minimize down time to loading. In some cases, it is necessary to load stock automatically.

A good example of an operation requiring close attention to material supply is in the production of leveling screws having a 1-14 thread with an overall length of 8 inches each. The machine on this operation consumes a total of 6 bars, 1 inch in diameter by 12 feet long, every 4½ minutes. Manual loading of stock reels takes at least another 4½ minutes and relatively heavy manual labor is involved.

Provisions for handling of finished parts also must not be neglected. Often the most precise parts are ruined by careless handling. It is expensive to use an operator's time to pick up and place completed pieces in a particular location. Clever tooling can take over this job and minimize costs and damage to the product.

To assure that all these factors are properly considered at the start of a job, a check list similar to the following may be of great value in preparing for carbide tooling of an automatic.

Material:
1. Chemical composition or corresponding SAE equivalent (Brinell or tensile strength is helpful but insufficient information).
2. Cutting speed, in surface feet per minute, for the material; tool life in minutes and in pieces obtained between grinds; amount of material removed per grind, and total tool life in pieces produced.
3. Expected and actual variation of stock, size, shape, surface condition and material condition.
4. Stock diameter of bar; if tubing, outside and inside diameter should be given; whether tube is seamless,
5. Forgings, castings and stampings. Samples should be included with data. This indicates gripping surface, cored places and handling requirements.

Dimensions:
1. Allowable tolerances on all dimensions.
2. Amount to be allowed for removal on chucking work, also draft angles.
3. Forging or casting drawing.
4. Concentricity expected.

Finish:
1. Allowable finish on all surfaces. If finish requested cannot be readily maintained, personnel should note.
2. Amount to be left for grind or any subsequent operations.

Operations:
1. To be checked before and after, or between work accomplished on automatic.
2. Special operations.

Production:
1. Number of hours per working day and required production on each part should be stated.
2. Tolerances, when closer than 0.003 inch (0.08 mm on foreign work) on both inside and outside, an entirely different tooling arrangement is involved.

Drawings:
1. Screw machine drawing should be available.
2. Part drawings should be studied for practicability of production.

The above check list should be carefully examined at the time of the layout of the job. The part print should be approved or marked up with required changes if necessary. If marked, the changes should each be noted, dated and initialed. If gages are to be used, gage sizes including gage tolerances should be marked on the drawing. This should be a must and eliminates many tool changes.

Once a job is ready to set up, real record keeping, including elements outlined in TABLE 5, should be instituted to establish an efficient operation. These records can also be used at any time an improvement in method is contemplated.

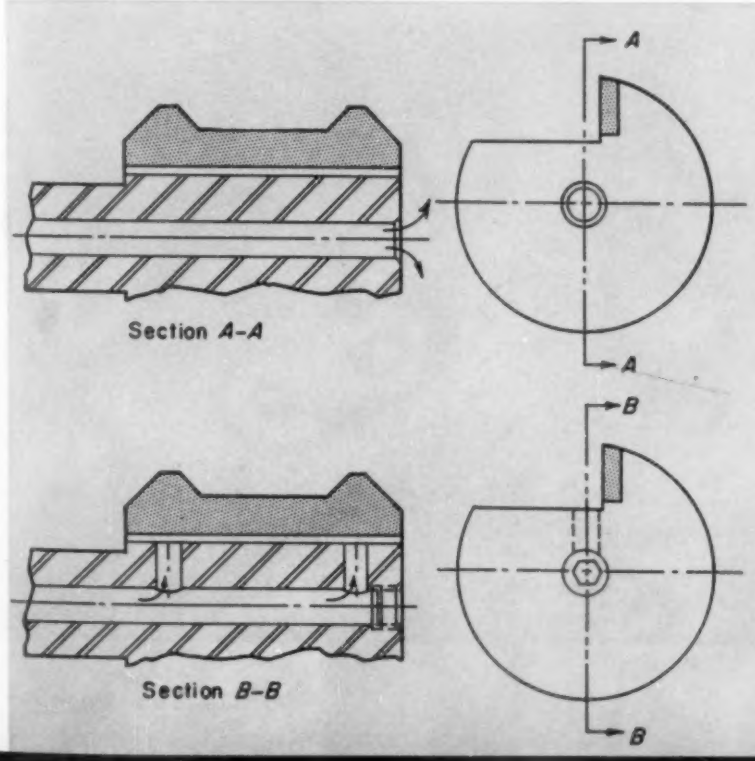
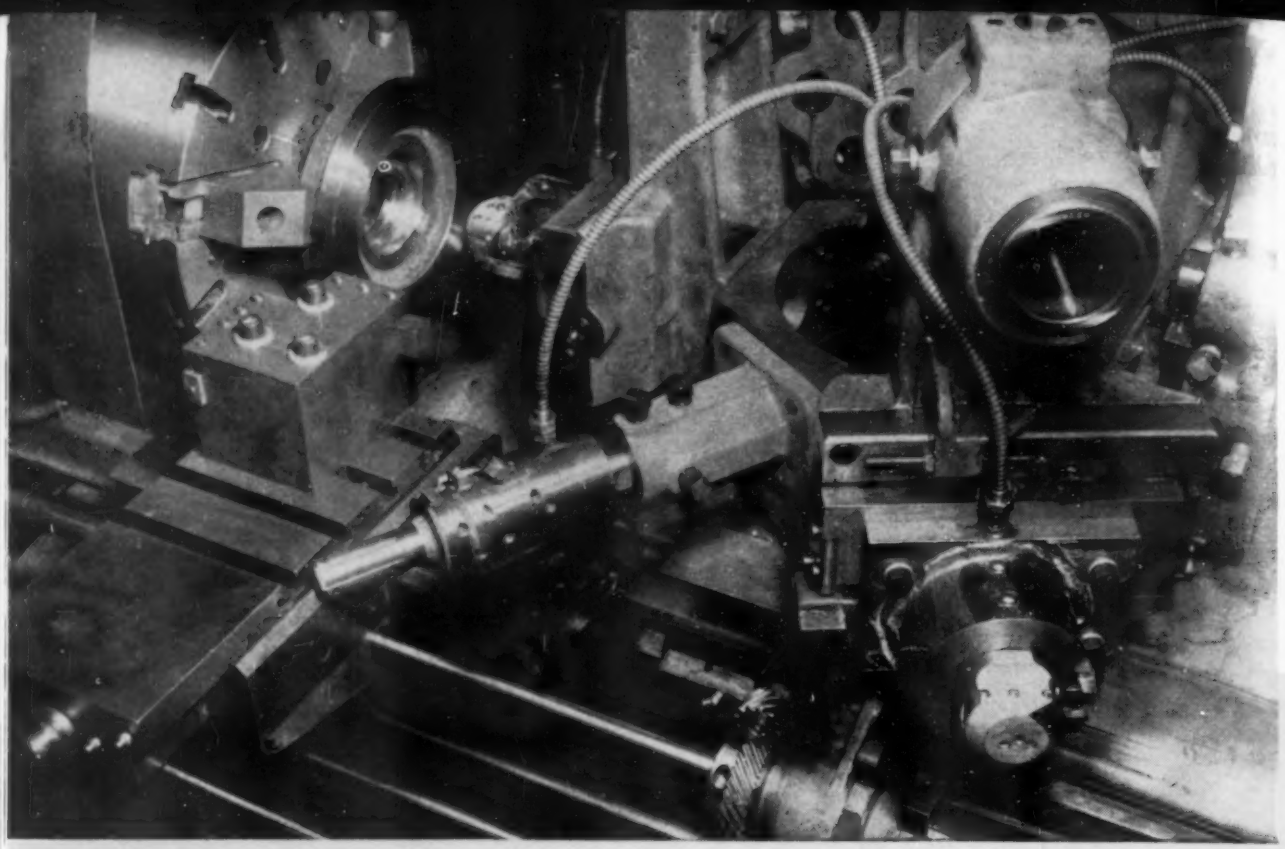
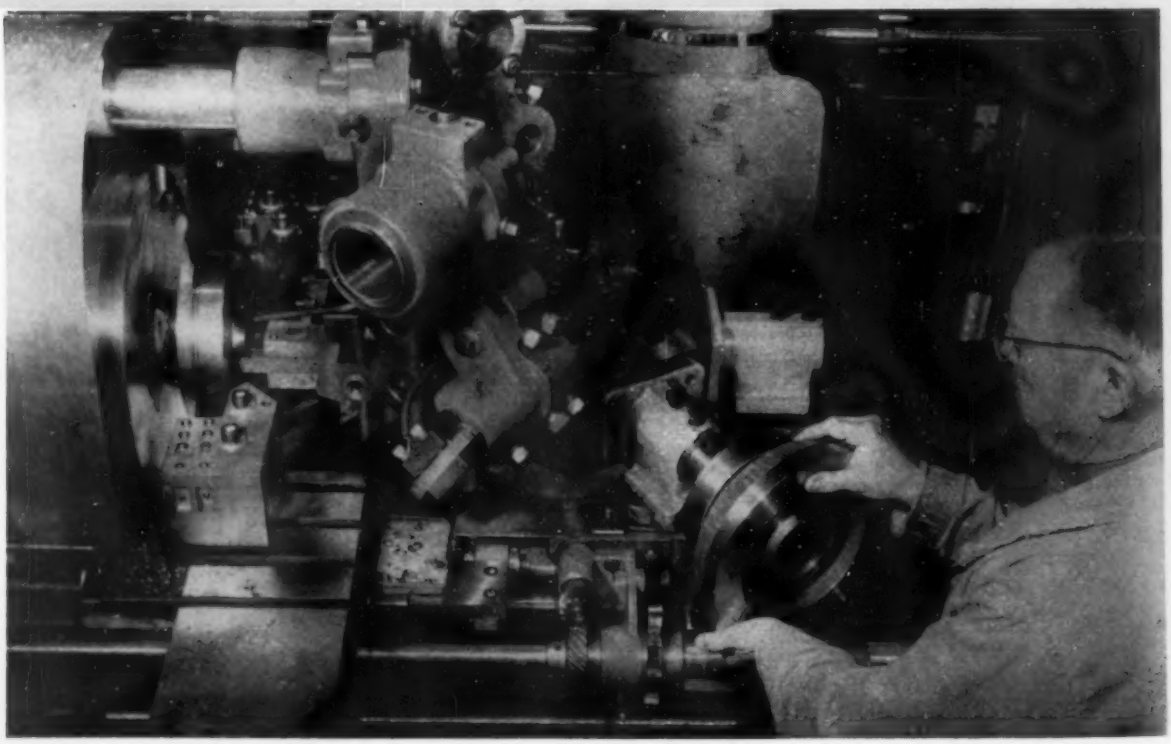


Fig. 7. Properly designed internal necking tool directs cutting fluid to each cutting edge continuously. Upper sketch shows tool that chipped out due to intermittent cutting fluid supply. Redesigned tool (bottom) gives efficient operation.

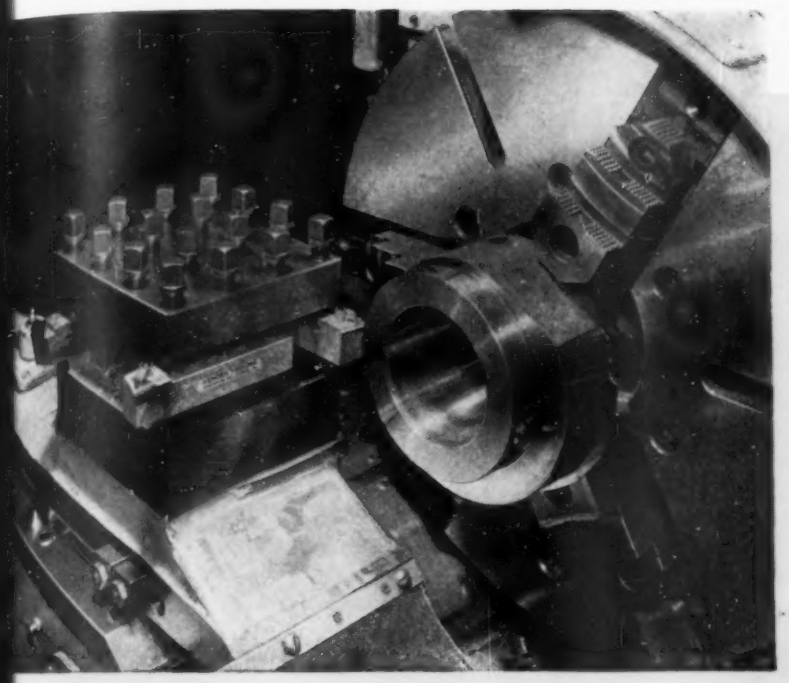


MULTIPLE MACHINING OPERATION on bomb base plug involves rough and finish boring, co-boring, turning, facing, grooving and chamfering. Turret facing attachment on rear cross slide actuates turret facing slide tools for rough and finish ID grooving from stations 2, 4 and 6 of Gisholt automatic turret lathe. Floor-to-floor time is 6.25 minutes.

(Below) The second operation on the steel forging workpiece consists of rough and finish turning OD, facing and chamfering. Turret facing attachment on rear cross slide actuates turret facing slide tool which carries facing tool with circular insert across face of part. Special loading arbor on station 1 holds workpiece square when chucking and reduces time between machining cycles. Floor-to-floor time is 7.2 minutes.

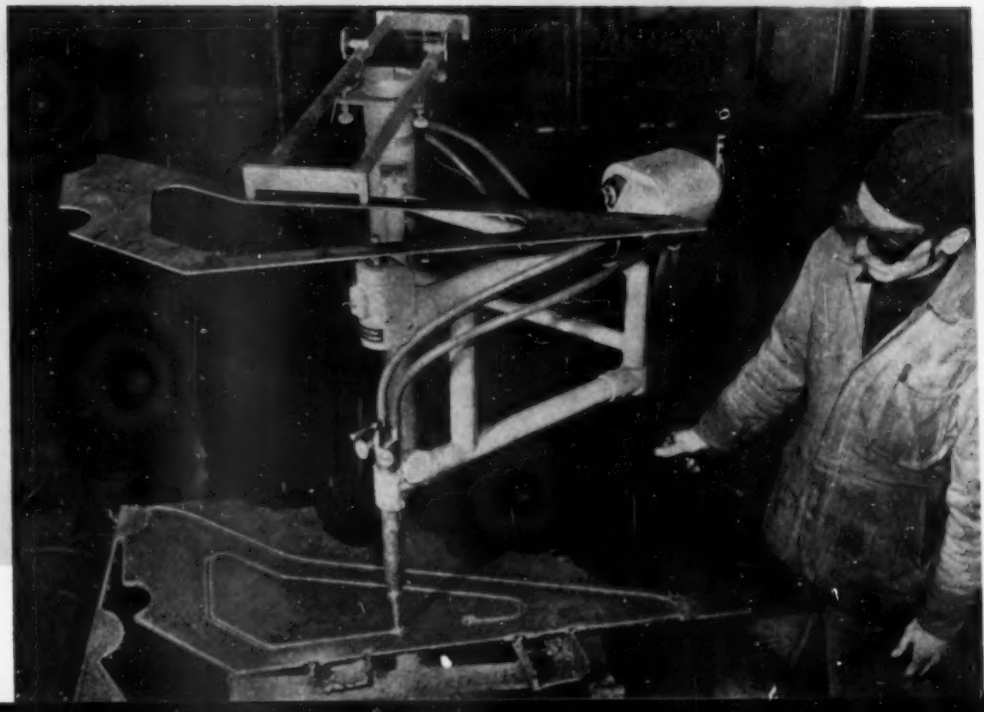


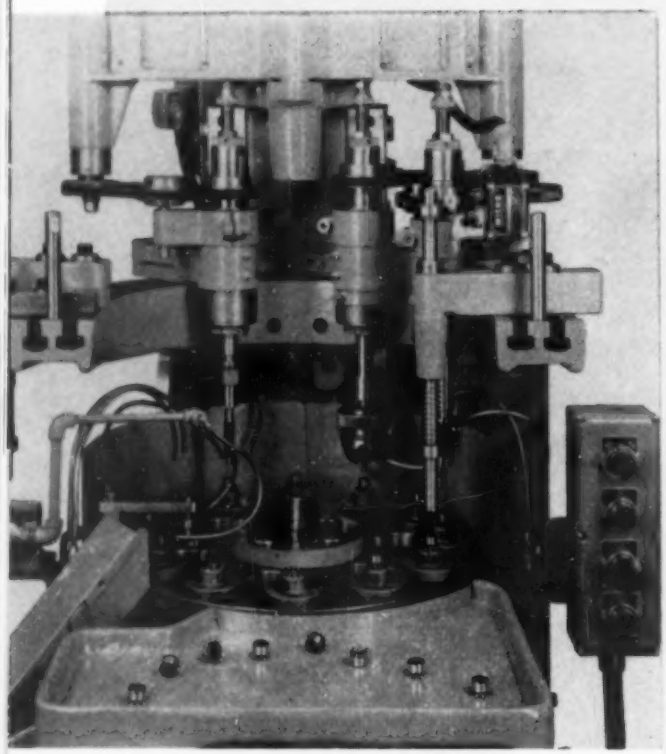
TOOLS at work



SEVERE INTERRUPTED CUTTING was required in producing this 8-inch machine cam. The workpiece is cast alloy steel, Rockwell C-20, and has a 2½-inch eccentric as well as two ½-inch diagonal bolt holes in the 6-inch diameter collar. The operation includes rough and finish turning and facing on a Warner & Swasey turret lathe. Turnover type Kennametal throw-away button carbide inserts are used for economy.

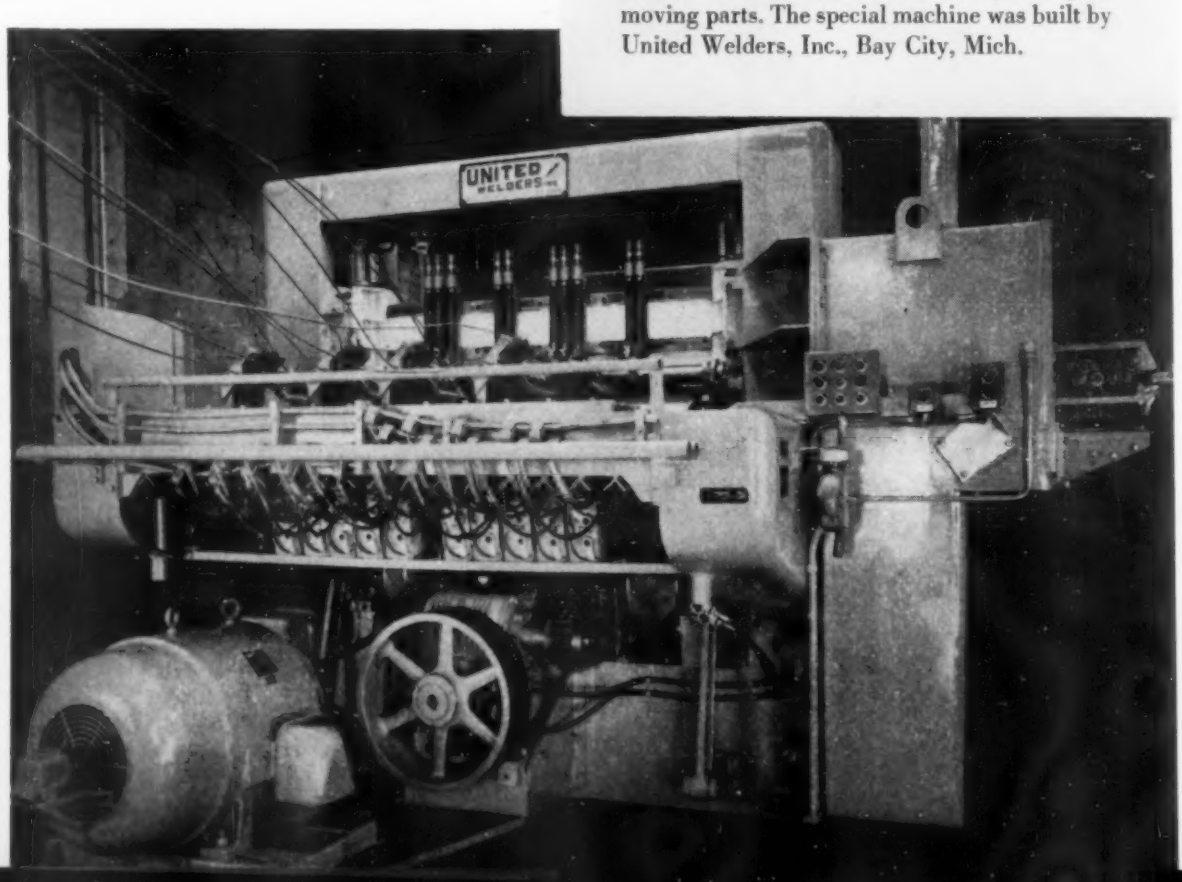
MECHANIZATION of torch cutting operations is used to produce contoured parts at Bos-Hatten, Inc., Buffalo, N.Y. An Alnico magnet holds the tracer against the template with a force of 3 to 12 pounds, in this Heath Engineering Co. machine. Cutting orifice of the torch is in same center line as tracer, giving greater than usual accuracy. Part is tack welded to front of stand.





CAPSULED AUTOMATION is exemplified by this automatic multispindle machine which produces 1070 small-motor commutators in a 50-minute hour. Operations in the Bodine special machine include hand feeding in first station and in succeeding stations, automatic inspection for positioning; carbide ream center shaft hole in bakelite, 0.3145-0.3165 diameter; carbide hollow mill OD, 0.691-0.693 diameter with piloted hollow mill; carbide face bakelite shoulder piloting in reamed hole and automatic ejection.

CROSS-WIRE RESISTANCE WELDING operation is automated in this high-production machine. Production is 1298 seat assemblies per hour with automatic clamping, welding and shearing operations. Sixteen strands of wire are fed simultaneously from the front while a single strand feeds from the right to form wire matting, with a weld at each joint and 40 welds per assembly. The 50-hp motor in foreground drives Cone-Drive speed reducer operating all moving parts. The special machine was built by United Welders, Inc., Bay City, Mich.



controlling climate effects

to meet industry needs

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Methods for coping with climate are well established in industrialized areas of the United States. Practices are different in various parts of the country but are of general interest. Since engineers may be forced, because of disasters or relocation, to carry on operations under climatic conditions with which they are unfamiliar, climatic problems would require urgent answers. This article presents answers to problems, which could arise in metalworking plants, while there is time to study them.

EVERYBODY TALKS about the weather but engineers have to do something about it. Weather can't be controlled but its effects can be anticipated and guarded against. In established plants, adaptations to climate are so commonplace and routine that they are taken for granted. Production is hindered if these adaptations are inadequate and chaos would result if they were suddenly made ineffectual.

Most manufacturing operations are conducted within weather-tight buildings but fire or explosion may suddenly expose them to the climatic elements, TABLE 1. Prior knowledge and precautions may alleviate the consequences. Also, as industry decentralizes, new plants may be built in unfamiliar climate areas. A change in climatic conditions may adversely affect customary practices. Some activities, such as transportation, must be carried on outside and their performance is vital to the conduct of manufacturing.

Teams of geographers and engineers have investigated methods of coping with climatic conditions and reported on various industries. Influences found during investigation into manufacture of aircraft and motorized military equipment will be discussed because these industries have much in common with other metalworking industries. Consideration is given to the effects of weather on basic elements of production such as labor, materials, equipment and processes. It should be remembered that climatic effects can be additive. If either wind or rain could slow activities, their combination would have greater effect.

Effects of climate on industry are only part of the story. The elements to which industry is exposed depend on climate. Climate is a composite or generalization of all day-to-day weather conditions over a period of years. Each climatic region is influenced by a number of factors called climatic controls. Eight controls, *Fig.* 1, determine the intensities of the three climatic elements of temperature, precipitation and humidity, and wind and air pressure. Combination of these elements results in weather. Storms are the most powerful of climatic controls and may drastically alter the effects of all the others.

Temperature and Labor: Temperatures of 60 to 75 F are considered best for most work. Somewhat lower temperatures may stimulate those doing heavy labor and promote efficiency. The curves of *Fig.* 2 show how labor efficiency is affected above and below the optimum temperature range. Workers not accustomed to low temperatures

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Table 1—Important Climatic Conditions

Temperature:	high, low, diurnal and annual range
Precipitation:	rain, snow, sleet and ice
Humidity:	also presence of salt
Wind:	also presence of sand or dust
Miscellaneous:	sunlight, fog, etc.

and those confined to sedentary jobs rapidly lose their efficiency as temperature drops. Tasks requiring dexterity become more difficult.

Workers engaged in heavy labor, such as construction, particularly if well clothed and accustomed to low temperatures, can maintain the best pace at low temperatures. As temperature falls, however, clothing becomes more bulky and cumbersome, and workers lose more and more time finding ways to keep warm. Accidents are reported highest at low temperatures. At —40 F, arctic natives normally become inactive; at —50 F, man spends almost all his energy in efforts to survive.

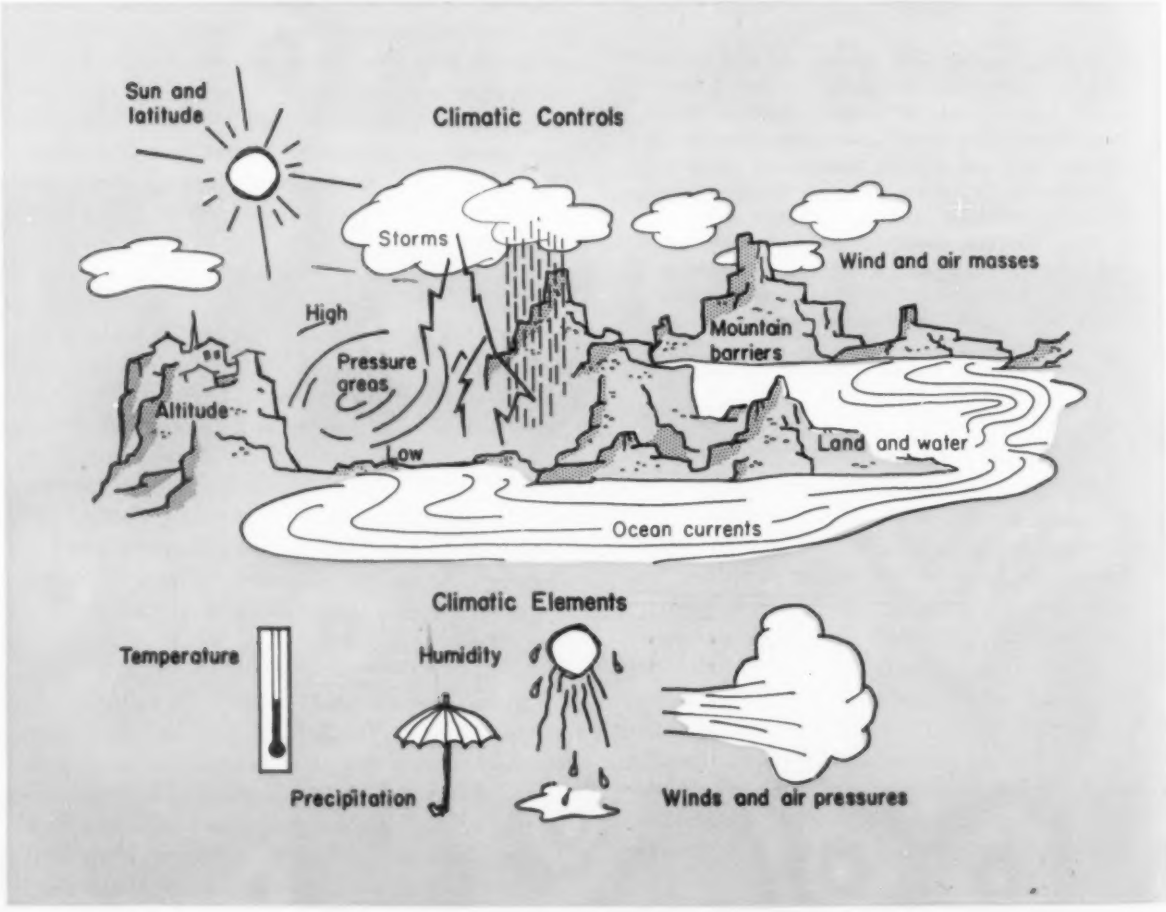
At high temperatures, workers tend to avoid exertion and hot zones. Less attention is paid to safety precautions than at optimum temperatures and perspiration makes handholds slippery. Tools and other metal objects become hot and hard to handle, especially when exposed to direct sunlight.

Conditions summarized in *Fig.* 2 are based on near ideal conditions of wind, precipitation and humidity. At low temperatures, strong winds increase working difficulties markedly. Soaking rain or heavy snow are likewise detrimental. Temperatures above 100 F become unbearable as the humidity rises.

Temperature and Equipment: One of the most pronounced effects of low temperature is the embrittlement of most ordinary carbon steels somewhere in the range of 0 to —30 F. Parts made of usual grades of steel exhibit strength reductions up to 50 percent and can snap under impact loads. Steel rails are prone to fracture at such temperatures. Ingots and structural shapes have been known to break from rough handling at low temperatures.

Where low-temperature operation can be anticipated, equipment can be especially designed. Many alloy steels retain their ductility at temperatures below any experienced naturally on the earth's surface. Low carbon steels can be treated to have good impact values at temperatures as low as —76 F.

Fig. 1. Natural climatic controls determine climatic elements for any locality and produce the individual types and varieties of weather.



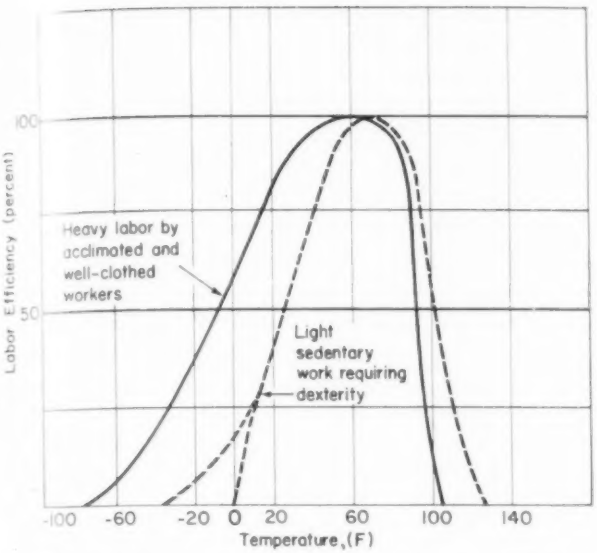


Fig. 2. The temperature range of human activity is not large. The range of efficiency is even more restricted. Efficiency curves were prepared under conditions of little or no wind, sleet or ice.

Ordinary rubber becomes stiff and plastics become defective at low temperatures. Oils and greases are available for operations at almost any temperature but those adequate at temperatures above 0 F must usually be diluted or replaced at lower temperatures. Diluents for engine oil vary from 5 percent kerosene at —25 F to 20 percent gasoline at —70 F. Since diluents evaporate, they must be renewed before every idle period. Hard starting is one of the most harmful effects of improper lubricants. Oils of sufficiently low viscosity to be satisfactory at —50 F are not considered satisfactory above —35 F.

If operations were attempted at low temperatures with lubricants satisfactory for temperatures over 50 F, problems would arise that might require up to a year to solve. Much time could be saved if lubrication experts were consulted prior to the damage that could result in exposed operations.

Temperature, Processes and Transport: Water is the most common processing substance. When it freezes, results may vary from a halt in a process to disastrous damage from broken pipes, radiators and containers. No start has been made toward damage control or prevention unless full provision has been made to drain water pipes quickly, heat necessary storage tanks and adequately insulate lines in which flow is expected to continue. In some instances, antifreeze solutions may be used. Water discharged into sewage and waste-disposal systems must not be overlooked when considering the harmful effects of freezing.

Frost collects on conveyor belts at 15 to 32 F and causes slippage. Wet conveyor belts may freeze to rollers and be ripped apart at starting.

Bulk materials exposed to moisture can present difficult unloading and handling problems at below-freezing temperatures. Viscous liquids are difficult to unload cold from tank cars, and volatile liquids expand and vaporize excessively at high temperatures.

Transportation of all kinds is hindered by low temperatures combined with snow and ice, but temperature extremes alone can cause decided difficulties. Idle locomotives at —50 to —70 F have to be moved at least every two hours. Diesel locomotives must be housed if temperatures are —40 F or lower. Journal starting resistance increases 50 to 60 percent below 0 F. Hot box occurrences increase as temperature changes above or below 40 F. The tonnage that can be hauled by diesel locomotives is reported to decrease 15 percent from 0 to —20 F, 20 per cent at —40 F and 40 percent at —60 F. Tonnage may be further reduced 10 percent for steam locomotives and as much as another 10 percent if running into strong winds.

Laying rails is not practical below 0 F. On the other hand, rails cannot be disturbed when too hot because their expansion joints are tight. Breakage of rails is about 50 percent greater in winter than in summer. Freezing is detrimental to roadbeds.

Temperature and Construction: Buildings can be constructed at almost any temperature but extra difficulties are experienced and special arrangements have to be made at low temperatures. TABLE 2 indicates the low temperature limits for economically carrying on construction operations by conventional methods. Concrete and masonry must be preheated and protected below 32 F. Concreting operations during a winter with temperatures below 32 F for 6 months, below 10 F for 3 months and below 0 F for one month are reported to cost 8 percent more than warm weather operations. At —68 F, it is estimated that the cost would be four to five times normal. Riveting is considered preferable to welding below 32 F because of the reduced possibility of inducing stresses. Most building materials can be stored at any temperature, but brick, tile and concrete blocks suffer deterioration at low temperatures with precipitation.

The lower the mean temperature in a locality, the more costly is construction. As an example, it costs about 50 percent more to build an aircraft plant in Central Ohio than a similar one in Southern California. It has been suggested that climatic hindrances to housing can be practically eliminated by going underground.

Effects of Precipitation: Rain decreases working efficiency. Under rainy conditions at 50 F and without wind, workers well clothed in rain trousers, jackets, hats and boots lose only about 10 percent in efficiency. When exposed to rain and

strong winds, men cannot remain dry for much more than one hour regardless of how well they are clothed. Construction operations are reported to be curtailed about 20 percent at Ketchiekem, Alaska, where the average annual rainfall is around 150 inches.

At low temperatures, labor efficiency and safety are still further impaired by precipitation. Sleet or ice are considered more limiting to outside work than rain or snow. Workers will generally not continue working during a sleet storm. Precipitation has been found more serious than freezing temperatures in reducing efficiency of an outside railroad car building line in a mild climate. In 23 days of rain, 97 cars or about 35 percent were lost out of a scheduled 278. During 5 days of ice, snow, sleet and rain, 28 cars or 50 percent were lost out of a scheduled 56. Only 4 cars out of 14 were reported lost because of cold weather alone.

Equipment in a damaged plant may be vulnerable to precipitation. Many machine tools are well covered but water can seep into others not designed for exposure to moisture in normal operation. Exposed metal surfaces can be protected by grease. Electrical equipment may be quickly damaged if not waterproof. In the event of unforeseen exposure to the weather, equipment should be placed under temporary covering. Equipment in flooded plants must be completely cleaned and renovated. Rainfall should be considered during selection of a plant

Table 2—Low Temperature Limits for Economic Operations in the Construction Industry

Operation	Temperature (F)
Surveying	−10
Excavating	20
Pile driving	20
Concrete forms	0
Concrete pouring	10
Masonry	10
Structural steel erection	10
Carpentry	−20
Roofing	40
Plumbing and heating	−20
Electrical installation	−30
Painting	32

site. Good drainage and runoff are necessary if flooding is to be avoided during heavy rainfalls.

Floods and washouts are serious hindrances to transportation. Other activities in an area dependent upon transportation may be interrupted until service is restored. It is estimated that 10 percent of all railroad accidents are caused by moisture conditions. Excessive rain causes dangerous pockets in roadbeds, slumping of embankments, slides of the sides of cuts and fouling of signals.

Snow has several effects. A heavy snowfall or a moderate snowfall accompanied by winds of 30 to 50 mph can reduce surface visibility to almost zero. About 10 percent of a plant's labor force can be required to keep roads and paths clear to storage when snow is 12 inches or more deep.

Heavy snowfalls can be handled with adequate equipment. Without necessary facilities, snow and ice can tie up all transportation and interfere seriously with people getting to work. A Youngstown, Ohio plant was closed for one week as the result of a 46-inch snowfall. Some plants store rations for emergency use during periods of heavy snowfalls.

Tonnage carried by trains that must fight heavy snowdrifts may be reduced 50 percent. Extensive measures have been devised and are used by railroads for taking care of snow. These methods are applicable to other forms of transportation used to supply industry.

Ice storms occur at temperatures of about 32 F. Ice accumulates on and breaks wires, poles and cross arms of railroad and utility lines so that power and communication are cut off. Freezing of switches has an adverse effect on railroading.

Effects of Wind: Wind velocity up to about 15 mph is of little consequence. Depending on the work being done and considering moderate temperatures, labor efficiency gradually declines with increasing wind speeds over 15 mph and rapidly approaches zero between 40 and 60 mph. Winds of 40 mph are likely to stop work on scaffolding. Winds of 40 to 50 mph have been found to decrease aircraft assembly efficiency when large parts must be handled.

Wind is particularly detrimental when present with low temperatures, ice, snow, rain, dust or sand. Work is reported to almost cease at 0 F with a 20-mph wind. In one instance, operations were continued under temporary shelter after extensive plant damage and a production loss of 25 to 50 percent was experienced during windy and moderately cold or wet weather.

Motors, bearings, fans, gears and pumps are particularly susceptible to windblown dust and sand. Painting is halted when dust is blown by winds over about 15 mph. Shields are necessary for welding when wind velocity is over 20 mph. Transportation is most affected by wind when it is combined with snow to result in drifts, but headwinds can reduce tonnage carried.

Types of Climate: Knowledge of the climate of an area gives a good insight into the types of vegetation and soil to be expected and some idea of the forms of industry that can be carried on efficiently.

In this article, climate is broken into five basic types, each with subtypes. These are: tropical, arid, middle latitude temperate, humid continental and polar. Another climatic condition, per-

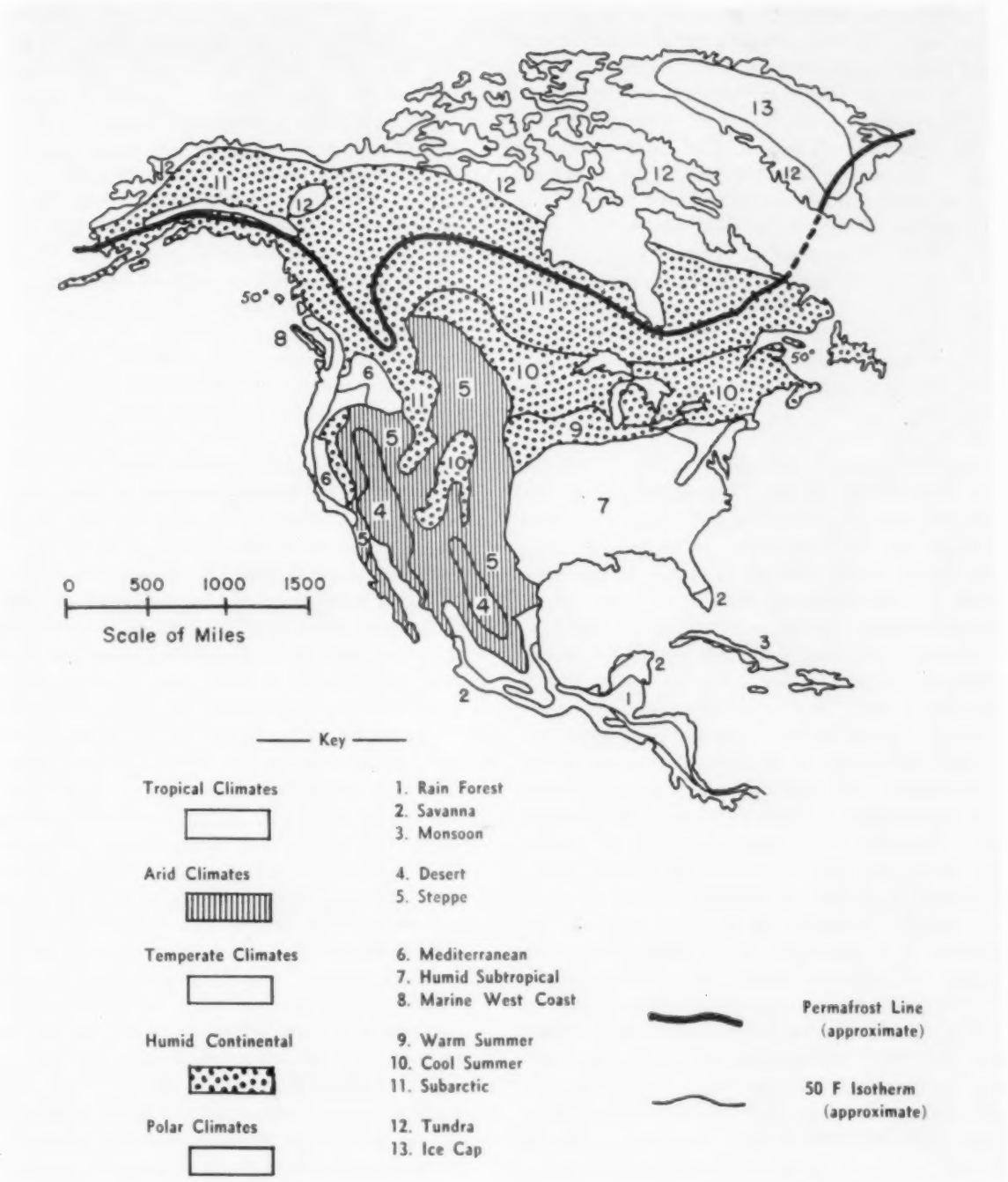


Fig. 3. Distribution of climate types on the North American Continent.

mafrost, will also be considered. The map in *Fig.* 3 indicates the distribution of climate types in North America.

TROPICAL CLIMATES: The uniformly high temperatures of the tropics are not as high as those of arid or humid continental areas. Temperatures between 77 and 80 F are normal with an annual temperature range between 1 and 10 deg Fahr, depending on the latitude. Nighttime is considered the winter of the tropics because the diurnal temperatures may vary as much as 20 deg Fahr, which is considerably more than the annual range.

Although actual temperatures are not extremely high, the sensible temperature feels high because relative humidity is usually high. The constant, uniformly high temperatures of the humid tropics prove enervating to white men after a period of time. Periodic returns to climates with an annual temperature fluctuation are necessary to maintain efficiency. High humidity is also hard on equipment because it is the major cause of steel corrosion.

Tropical climates may be subdivided into three

distinct types: rain forest, savanna and monsoon. The main difference among these is in the amount and time of occurrences of precipitation, TABLE 3. In the tropical rain forest there is no dry season. Daily afternoon convectional rainfalls add up to a high annual precipitation. The tropical savanna has a dry season in winter and a lower average annual rainfall. Because the monsoon climate has a dry season, all the precipitation comes in the summer. Annual total rainfall, however, is high.

In addition to high humidity and heavy, frequent rains, tropical climates can hinder manufacturing in other ways. Abundance and rapid growth of vegetation cause much difficulty in the establishment and maintenance of rail and highway transportation systems.

ARID CLIMATES: Arid areas can be subdivided into deserts and steppes. The difference between the two is in the amount of precipitation. Deserts average less than 10 inches of rainfall per year and steppes between 10 and 20 inches. Effectiveness of the rainfall establishes the real boundary. Evaporation usually exceeds precipitation in deserts.

Dry climates cover large portions of the earth's surface. Not all the dry areas are sandy deserts near the equator. Vast arid areas exist in what are normally considered cold regions. Because of lack of moisture in the atmosphere, arid areas receive large amounts of insolation which raises the daytime temperatures to high extremes, particularly in lower latitudes. Conditions are ideal for testing aircraft in dry areas because of high temperatures at ground level and cold at high altitudes.

A specific problem that must be faced in dry climates is the procurement of sufficient water for human and industrial needs. Vegetation is sparse and foodstuffs must be imported. Also, because of lack of moisture in the air, arid areas cool rapidly after the sunset and the diurnal temperature range may be as high as 100 deg Fahr although the annual temperature range may be only 30 deg Fahr. Such large daily temperature variations would be detrimental to precision metalworking operations.

Precipitation in arid areas usually comes as a cloudburst. The parched ground cannot possibly absorb it all immediately. Low, flat areas are prone to flooding with all of its attendant threats to industrial activity. Washes and gullies that are dry most of the year become raging torrents following a cloudburst and railroad trackage in such areas is particularly vulnerable to damage.

TEMPERATE CLIMATES: Areas with adequate but not excessive rainfall, a cool season where at least one month has a mean temperature below 64 F and no month with a mean temperature below 27 F are classed as temperate. Variable weather is an outstanding feature of such climates. Between latitudes 30 deg and 60 deg, north and south, the frontal activity caused by continental air masses is greatest. Because of the north and south seasonal movement of the sun, the belt of prevailing westerlies varies in latitude between summer and winter. A hurricane season occurs in late summer or early fall on the east coasts of major continents.

For convenience, the temperate climatic type may be divided into two subgroups. Those with a dry season in summer are represented by the Mediterranean type climate, those without a dry season are represented by the humid subtropical and marine west coast climates.

The Mediterranean type of climate occurs on the subtropical margins of the middle latitudes. Annual precipitation of 25 to 35 inches with a summer drought is characteristic. The summer months have extremely meager rainfall, high daytime temperatures and low relative humidity. Active work can be carried on all year with little or no cover. Outside final assembly and fitting operations for aircraft can be accomplished in this area.

Humid subtropical climates have relatively abundant precipitation, usually averaging 30 to 65 inches per year. There is no marked dry season, but often more rain falls in summer than winter. Average temperature for the warmest month varies between 75 and 80 F with high absolute and relative humidities. Nights are hot and humid because the moist air retains the daytime heat. Winter temperatures average 40 to 55 F for the coolest months. Annual temperature ranges are usually small, depending upon the latitude. The outside car assembly line of a railroad system in Roanoke Va., represents exposed industrial activity in a mild humid climate.

West coast marine climates occupy the westward or windward sides of mid-latitude continents. The definite marine influence holds down summer temperatures and raises winter temperatures. Prevailing westerly winds bring considerable precipitation. Summer temperatures are cool, with the warm month averaging between 51 and 66 F. A few days may be in the 90's. Winter temperatures are mild for the latitude, especially in Europe. Temperature averages between 35 and 50 F for the cold months. Unusual cold spells can and do occur with considerably lowered temperatures for a short time.

The amount of precipitation received depends on the topography of the land surface in back of marine west coast climates. Where a mountain barrier exists, precipitation totals of 100 to 150 inches per year may occur. Where lowlands back up the coast, the rainfall may be only 20 to 35 inches per year.

HUMID CONTINENTAL CLIMATES: Continental climates are found within large land masses and are strictly land controlled. Annual temperature changes are large and during three to eight months

Table 3—Characteristics of Climate Types

	Month													
	J	F	M	A	M	J	J	A	S	O	N	D	Year*	Range
Tropical Rain Forest—Colombo, Ceylon														
Temp. (F)	80	80	82	83	83	82	81	81	81	81	80	80	81.0	3
Precip. (in.)	3.2	1.9	4.3	9.7	10.9	7.3	4.4	3.2	4.8	13.4	11.8	5.1	80.0	
Tropical Savanna—Mandalay, Burma														
Temp. (F)	70	75	83	90	89	87	87	86	85	83	76	71	81.7	20
Precip. (in.)	0.1	0.1	0.2	1.1	5.8	5.5	3.3	4.6	5.7	4.7	1.6	0.4	33.1	
Desert—Baghdad, Iraq														
Temp. (F)	49	54	61	71	81	90	95	94	88	80	63	53	73	46
Precip. (in.)	1.2	1.3	1.3	0.9	0.2					0.1	0.8	1.2	7.0	
Steppe—Denver, Colo.														
Temp. (F)	30	32	39	47	57	67	72	71	62	51	39	32	49.7	42
Precip. (in.)	0.4	0.5	1.0	2.1	2.4	1.4	1.8	1.4	1.0	1.0	0.6	0.7	14.3	
Temperate with Dry Season (Mediterranean)—Red Bluff, Calif.														
Temp. (F)	45	50	54	59	67	75	82	80	73	64	54	46	62.3	37
Precip. (in.)	4.6	3.9	3.2	1.7	1.1	0.5	0.0	0.1	0.8	1.3	2.9	4.3	24.4	
Temperate with no Dry Season (Humid Subtropical)—Charleston, S. C.														
Temp. (F)	50	52	58	65	73	79	82	81	77	68	58	51	66.1	32
Precip. (in.)	3.0	3.1	3.3	2.4	3.3	5.1	6.2	6.5	5.2	3.7	2.5	3.2	47.5	
Temperate (Marine West Coast)—Seattle, Wash.														
Temp. (F)	40	42	45	50	55	60	64	64	59	52	46	42	51.4	24
Precip. (in.)	4.9	3.8	3.1	2.4	1.8	1.3	0.6	0.7	1.7	2.8	4.8	5.5	33.4	
Humid Continental (Warm Summer)—Peoria, Ill.														
Temp. (F)	24	28	40	51	62	71	75	73	65	53	39	28	50.7	51
Precip. (in.)	1.8	2.0	2.7	3.3	3.9	3.8	3.8	3.2	3.8	2.4	2.4	2.0	35.1	
Humid Continental (Cool Summers)—Montreal, Canada														
Temp. (F)	13	15	25	41	55	65	69	67	59	47	33	19	42.3	56
Precip. (in.)	3.7	3.2	3.7	2.4	3.1	3.5	3.8	3.4	3.5	3.3	3.4	3.7	40.7	
Humid Continental (Subarctic)—Dawson, Yukon (64° N - 139° W)														
Temp. (F)	−23	−11	4	29	46	57	59	54	42	25	1	−13	22.4	82
Precip. (in.)	0.8	0.8	0.5	0.7	0.9	1.3	1.6	1.6	1.7	1.3	1.3	1.1	13.6	
Polar (Tundra)—Barrow, Alaska (71° N - 150° W)														
Temp. (F)	−19	−13	−14	−2	21	35	40	39	31	16	0	−15	9.9	59
Precip. (in.)	0.3	0.2	0.2	0.3	0.3	0.3	1.1	0.8	0.5	0.8	0.4	0.4	5.6	
Polar (Ice Cap)—Little America, Antarctic (79° S - 164° W)														
Temp. (F)	22	9	−7	−24	−27	−29	−24	−34	−29	−14	9	24	−11.2	58
Precip. (in.)			No Data											

*Temperature as arithmetical average and precipitation as total.

of the year temperatures average below freezing. Precipitation is plentiful throughout the year. Most of the northeastern United States industrial area is found within the warm summer and cool summer humid continental climate.

Industry in this climate on the North American continent can expect to suffer from precipitation and low temperatures in the event of extensive plant damage. The best precautions against climatic deterioration would seem to be to provide means to drain water or solutions quickly from lines, tanks and processing equipment, and provide a cache of temporary covering material such as tarpaulins.

Humid continental climates may be divided into warm summer, cool summer and subarctic types. The warm summer zone has summers almost identical to those of the humid subtropical area just to the south. This zone is subject to cold continental air masses from the arctic during the winter.

Just to the north is the cool summer zone with short summers and more severe winters. Daily temperature range is usually large and the winter months are accompanied by considerable ice and snow.

Subarctic climates include areas of tiaga, boreal forest and muskeg with mostly coniferous vegetation. Temperature ranges are large and winters

are severe. This zone varies in temperature from one to three months above 50 F, with the temperature of the coldest month below —36 F. The northern boundary is the 50-deg isotherm for the warmest month, *Fig.* 3.

Because vegetation needs a temperature over 42 F for growth, growing seasons in subarctic climates are short. Daylight persists much longer than it does further south and nights actually amount to short periods of twilight during the summer months. Winter begins immediately after the short summer season. Frosts occur in August and water begins to freeze in September. Days become extremely short with correspondingly long nights.

Most of the precipitation in the subarctic climate comes in the summer because the low specific humidity, the cold heavy settling air and the diverging wind systems during the cold winters are not conducive to precipitation. Total annual precipitation is usually between 15 and 20 inches. Snowfall is not heavy but tends to accumulate.

In subarctic climates, industrial operations without adequate housing would be grossly inefficient during a large part of the year. Satisfactory housing can be established but the season during which normal construction can be carried out is short. Procurement of water in industrial quantities and disposal of sewage can be critical in the subarctic. Transportation facilities would be strained because, during a large part of each year, goods and supplies to satisfy human wants would have to be shipped in, in addition to industrial supplies.

Polar Climates: The two types of polar climates are tundra and ice cap. Polar climates always have a warm month average below 50 F and an annual mean temperature of 32 F or below. The boundary line between tundra and ice cap is the warm month isotherm of 32 F.

The tundra is a transitional climate between the subarctic and the ice cap climates. The warmest months have an average temperature between 32 and 50 F. Winter temperatures average between —35 and —40 F along coastlines with even lower temperature inland. Precipitation is seldom more than 10 to 12 inches per year. Snowfall is meager but tends to drift. Most of the ground is snow free and frost can penetrate directly into the earth. As a result, the subsoil is permanently frozen.

Where the mean temperature does not exceed 50 F, the earth remains frozen over the years. This is known as permafrost and is found north of the heavy line shown on *Fig.* 3. The surface layer of the permafrost area is known as the active zone. It alternately freezes and thaws in winter and summer. This causes vertical motions of heaving and settling.

In the summer, when temperatures are above freezing, surface water collects in shallow pools, swamps and bogs. A large portion of the area is covered because water cannot seep into the frozen layers beneath. These pools serve as breeding grounds for multitudes of insects that are at the least annoying. Travel or transportation is extremely difficult over the soft thawed surface.

Although permafrost can extend for hundreds of feet into the ground, structures have been erected in this region. Most types of plants could be built on such ground but construction would be difficult and expensive. Construction techniques in the permafrost zone are unique.

An equilibrium, called the thermal regime, occurs in the ground permeated by permafrost. Customary building practices alter the natural thermal regime because of the warmth given off beneath the structure. Buildings would have to be designed to preserve the natural balance or create a new balance to prevent excessive settling and failure. The same thinking can be applied to individual foundations for heavy equipment.

Data on the ice cap climate is scanty. Mean annual temperatures are well below 0 F with the warmest months below freezing. Some precipitation occurs but not many measurements have been made. Ice cap climate has quite low temperatures but does not have the large temperature variations found in the subarctic.

Conclusions: In recent years, the importance of microclimatic observations has become more apparent. There are large variations in temperature even within small areas because of air drainage, varieties of vegetation and exposure. Weather data collected for a particular site prior to construction can be of high value.

Some of the most important temperature data required to evaluate the basic climatic character of a locality are: average daily temperature, range and variability; average monthly temperature, range and extremes; average annual temperature, and the frequency and duration of any temperatures significant to any phase of an industrial operation.

Basic data on precipitation should include average annual amount, seasonal distribution, intensity (which determines whether water is absorbed by the soil, or lost into streams or atmosphere) and the frequency of droughts.

By anticipating weather conditions for new plant locations and by being cognizant of weather extremes in current plant locations, engineers can minimize the effects of weather. Damage control plans can be outlined before need for them exists.

Acknowledgment: This article is based on information contained in "Climatic Criteria Defining Efficiency Limits of Certain Industrial Activities," a 559-page report prepared under contract with the United States Air Force by the University of Illinois.

Cemented oxide tool is making a half cut on hub of 7-foot, chrome-moly steel turbine wheel, having completed facing cut of wheel's OD and cut on hub.

higher cutting speeds

promised by cemented oxides

CUTTING SPEEDS in a range beyond even that of carbides are predicted for a new ceramic type tool material. Discovered by E. Golibar, Research Engineer of Carboloy Dept. of G. E. in Detroit, the experimental material is known as cemented oxide to distinguish it from other ceramics. Initial tests indicate the material may be used with good success for finishing operations at top speed ranges of current machine tools. Its performance is reported even better at speeds beyond 1000 sfpm.

Although no coolant is required, the material may be used with coolants if heat deformation of the work is a factor. The tool material does not heat up and is generally cool to the touch following a machining operation. Most of the heat is transferred to the chip and some to the work. Used with mechanical holders, tips of the new material not only will machine materials such as 1045 and softer steels, but also 4340 and nickel-chrome-moly steels with hardnesses up to Bhn 300, Carboloy engineers say.

Wear resistance of the new material is such that on some tests it indicated a tool life of considerably more than 25 to 1 over carbides. For finishing cuts, the material is expected to reduce cutting time drastically, taking up where carbides leave off. At present, tool geometries of 5 to 10 deg negative back and side rake, along with relief angles of about 10 deg, side cutting edge angles up to 60 deg and nose radii of $\frac{1}{16}$ inch seem to be most successful.

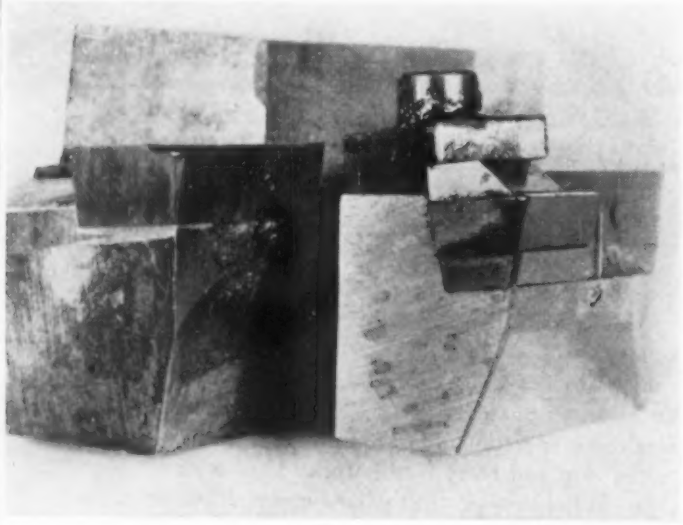
The new material shows a two-phase structure in photomicrographs. It has a transverse rupture strength of 80,000 to 100,000 psi, density of 4.10 to

4.20 and hardness of 93 to 94, Rockwell A. It offers very good resistance to oxidation and is generally resistant to corrosion. The above properties also suggest application where high temperature strength coupled with low density, resistance to oxidation at elevated temperatures, and combined abrasion and corrosion resistance are required.

Cemented oxide is made of materials which are in abundant supply and is processed by powder metallurgy techniques. Thus, ultimately, the usual variety of tool shapes should be available. Tool tips of cemented oxide are being wet ground successfully with 220-grit diamond wheels. Use of finer diamond wheels is possible but longer grinding time is required. Silicon carbide wheels have been used for rough grinding only. A honed edge around the cutting edge and nose radius of the tool tip is necessary.

In one spot test a cemented oxide tool was tried in making a 6½-inch facing cut on the hub of a 7-foot, sixth-stage steam turbine bucket wheel being machined on a 100-inch Cincinnati boring mill. In-

Comparison of wear in carbide tool, left, and cemented oxide tool tip. Carbide tool made only a half cut on 7-foot turbine wheel hub, while cemented oxide tip was used for two additional cuts, as noted in previous caption.



side diameter of the hub was 26⅜ inches with the outside diameter measuring 39⅜ inches. The material was chrome-moly steel with a Brinell hardness between 220 and 240.

Normally, the operation is run at 180 sfpm with carbide, but for this test the machine speed was increased to 425 sfpm. Before making the hub cut, the cemented oxide tool was used to make a complete 3¼-inch facing cut on the rim of the wheel at 1100 sfpm and a complete one on the hub at 425 sfpm. Then, to obtain a comparison, the same cemented oxide tool was used to make another half of a cut on the hub, finishing off the remaining half with a new carbide tool normally applied on the j

One of the accompanying illustrations shows t wear on the cemented oxide tool after making t two and one-half cuts, compared to wear obtain on the carbide tool making only a half cut on t hub. Wear land on both is about 0.010 inch.

For a comparison, the oxide was tested agai grade 831, one of the hardest carbides made. Usin a water soluble coolant with the machine spee stepped up to 485 sfpm, the cemented oxide too was used to turn 9½ inches on the outside diameter, with a depth of cut of 0.020 inch and feed of 0.010 inch. The oxide showed a wear land of about 0.002 inch after 17 minutes of cutting, while grade 831, under identical conditions made a cut of only 3 inches showing a wear land of about 0.010 inch, cutting for 5½ minutes.

Under dry conditions, both the cemented oxide and the carbide were used to make a cut 3⅛ inches wide on the outside diameter. Wear on the cemented oxide was hardly noticeable, while that on the carbide amounted to about 0.010 inch. In spite of the age of the machine, the finish provided by the oxide material was good.

In making a face cut on the same retaining ring, both the carbide and cemented oxide tools were run dry. Here again, the cemented oxide tool was used to make half the 2⅝-inch cut, with the carbide finishing the job. Machine speed varied from the inside to outside diameter of the cut from 415 to 485 sfpm. Both tools were used to make a 0.0625-inch cut with a feed of 0.011 inch. Wear on the cemented oxide tool was practically nil while the carbide showed a wear land of about 0.010 inch.

When the machine speed was reduced to 230 sfpm, the cemented oxide material still continued to make cuts without chipping, but seemed to push the metal off rather than part it with a shearing action. This might have been due to angles instead of material.

Tool geometries of the cemented oxide tips used in tests include an end cutting edge angle of 15 deg, lead angle of 15 deg and nose radius of 1/16 inch. Both the cutting edge and land were honed. The former 0.002 to 0.004 inch and the latter 0.025 inch on the 10-deg negative rake. The tools were mechanically held.

On widely used 1045 steel, finishing cuts were taken at 1800 to 2000 sfpm. Tool life of about 25 minutes was obtained at 2000 sfpm with depths of cuts of 0.010 inch and feeds of 0.005 inch. In other trial runs recently, cemented oxide was used on high-speed machines at speeds up to 2500 sfpm with good results. Development engineers feel that the tool material will have a definite influence in the design of future machine tools, putting emphasis on machines capable of removing metal at speeds up to 7500 sfpm. While still in the experimental stage of development, it is expected that the material will be available on a limited basis by the first of the year.

Surface Roughness, Waviness and Lay

BECAUSE OVERFINISHING is expensive, and underfinishing may prevent proper mechanical action and reduce visual appeal, considerable effort has been expended toward establishing definite classifications for roughness, waviness and lay. Also, symbols have been prepared so that any communication between designers, production engineers and users will have the same basis. These reference sheets will neither indicate how to achieve specific finishes nor give desirable finish values for specific purposes. Because surfaces are extremely complex, information is included only for height, width and direction of surface irregularities.

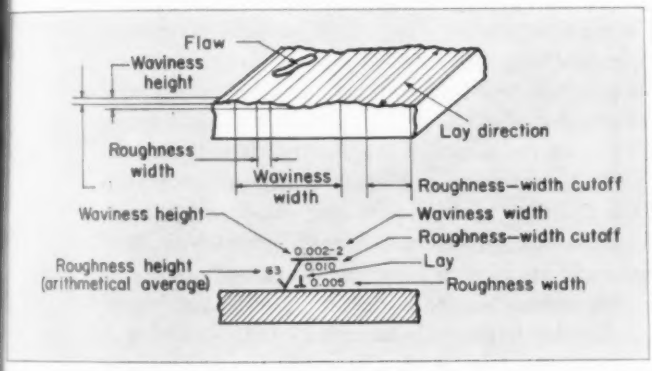
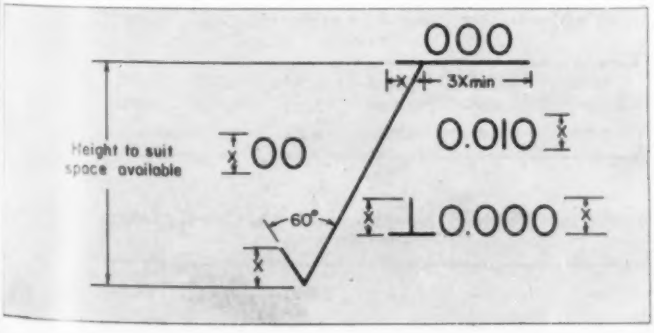


Fig. 1. Relation of symbols to surface characteristics.

Fig. 2. Typical proportions of surface symbol.



Definition of Terms: Surface of an object is the boundary that separates the object from another object. The nominal surface of an object is the theoretically accurate design for which shape and extent are usually shown and dimensioned on drawings and in specifications. Deviations from the nominal surface, *Fig.* 1, including roughness and waviness, are designated as surface irregularities.

The contour of a section perpendicular to a surface is referred to as the profile. Relatively finely spaced surface irregularities, the height, width and direction of which establish the predominant surface pattern are termed roughness. Roughness can be considered as superimposed on a wavy surface. Irregularities resulting from cutting edges and machine tool feed constitute roughness. Roughness height is rated in microinches arithmetical average deviation from the mean line. Roughness width is rated in inches as the maximum permissible spacing between repetitive units of the surface pattern.

Irregularities of the nominal surface that are of greater spacing than roughness are defined as waviness. Waviness can result from such factors as machine or work deflections, vibration, heat treatment and warping strain. Waviness height is rated in inches as the peak-to-valley distance. Width is rated in inches as the spacing of adjacent waves.

The roughness width is used to establish the roughness-width cutoff value which is always greater than the roughness width unless otherwise specified. Roughness-width cutoff is the maximum width in inches of surface irregularities included in the measurement of roughness height.

Direction of the predominant surface pattern, produced by tool marks or grains of the surface ordinarily determined by the production method used, is called lay. Flaws are irregularities that occur at one place or at relatively infrequent intervals in the surface. Scratches, ridges, holes, peaks,

Based on ASA B46.1-1955 and Appendixes.

cracks and checks are all classed as flaws in the surface and could produce incorrect readings.

Designation of Surfaces: The symbol used to designate surface irregularities is the check mark with horizontal extension, *Fig.* 2. Indicated value numerals should be the same size as the drawing dimensions. Line weight of the symbol should approximate that of the numerals. Where roughness height only is to be indicated, the horizontal extension can be omitted. Also, the top extension can be lengthened to the right as far as needed. The point of the symbol is positioned on the line indicating the surface, on the witness line or on a leader pointing to the surface. The long leg and extension are to the right as the drawing is read.

Where no surface control is indicated, it can be assumed that the surface produced by the process will be satisfactory. Where the symbol is used with a dimension, it affects all surfaces defined by the dimension. Areas of transition, such as chamfers and fillets, should conform with the roughest adjacent finished area unless otherwise indicated. Surface roughness symbols, unless otherwise specified, apply to the completed surface. Drawings or specifications for plated or coated parts should definitely indicate whether the symbols apply before, after, or both before and after coating.

=	Parallel to the boundary line of the nominal surface indicated by the symbol.
⊥	Perpendicular to the boundary line of the nominal surface indicated by the symbol.
X	Angular in both directions to the boundary line of the nominal surface indicated by the symbol.
M	Multidirectional.
C	Approximately circular relative to the center of the nominal surface indicated by the symbol.
R	Approximately radial relative to the center of the nominal surface indicated by the symbol.

Fig. 3. Symbols indicating direction of lay.

Table 1—Recommended Roughness Height Values (microinches)

0.25	5	20	80	320
0.5	6	25	100	400
1	8*	32*	125*	500*
2*	10	40	160	600
3	13	50	200	800
4*	16*	63*	250*	1000*
				1250
*Preferred values				1600

Associated with the surface symbol, is another symbol indicating the direction of lay. These symbols, *Fig.* 3, are indicated with the same weight of line as used for the surface symbol.

Roughness and waviness ratings, unless otherwise specified, apply in a direction that gives the maximum reading, across the lay. Recommended values for roughness height, waviness height and roughness-width cutoff are given in TABLES 1-3. Roughness-width cutoff values should be selected large enough to include all of the surface irregularities for which measurement is desired. All irregularities having a spacing less than the value of the roughness-width cutoff used are included in any measurement.

In some instances, such as for surfaces in which actual contact area is important, the largest convenient roughness-width cutoff should be used. In other instances, such as surfaces subject to fatigue failure, only irregularities of small width are important and more significant information can be obtained when a small roughness-width cutoff value is used. When it is desired to determine only widely spaced irregularities, such as identifying chatter marks on a machined surface, a long roughness-width cutoff instrument and a large radius stylus should be used. This combination will not respond to closely spaced irregularities. Effect of various values for roughness-width cutoff is shown in *Fig.* 4.

In *Figs.* 5-12, specification of roughness, waviness and lay is indicated by insertion of the desired ratings in appropriate positions relative to the surface finish symbol. Only those ratings required to adequately specify the desired surface are shown on any drawing. Roughness height ratings are placed at the left, *Fig.* 5, of the long leg of the symbol. When only one rating is specified, it indicates the maximum average, any lesser average is acceptable. Specification of maximum and minimum average roughness height values, *Fig.* 6, indicates the permissible range of the average rating.

Maximum waviness height ratings are placed above the horizontal extension, *Fig.* 7, and any lesser rating is acceptable. Maximum waviness width rating is placed above the horizontal extension and to the right of the waviness height rating.

Table 2—Recommended Waviness Height Values (inch)

0.00002	0.00008	0.0003	0.001	0.005	0.015
0.0003	0.0001	0.0005	0.002	0.008	0.020
0.00005	0.0002	0.0008	0.003	0.010	...

Table 3—Standard Roughness-Width Cutoff Values (inch)

0.003	0.010	0.030	0.1000	0.300	1.000

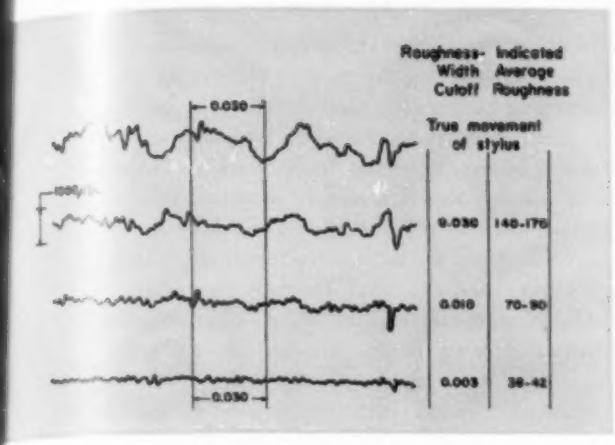


Fig. 4. Effects of various roughness-width cutoff values.

Fig. 8. Any lesser rating is acceptable. To specify contact area, the percentage value is placed above the extension line, *Fig.* 9.

Lay designation symbols, *Fig.* 3, are placed at the right of the long leg, *Fig.* 10. The roughness-width cutoff rating is placed below the horizontal extension, *Fig.* 11. When it is required, the maximum roughness width rating is placed at the right of the lay symbol, *Fig.* 12. Any lesser rating is acceptable. Where surface roughness control of several operations is required within a given area, or on a given surface, surface qualities may be designated as shown in *Fig.* 13.

Reference Specimens: To determine whether instrumentation is in proper operating condition, its performance can be checked through the use of precision reference specimens. Such reference pieces are designed to serve as performance specimens of surface roughness height. Such specimens do not have the appearance or characteristics of commonly produced surfaces.

The normal surface profile of roughness height specimens consists of a series of isosceles triangles having included angles of 150 deg, *Fig.* 14. A flat region can be permitted at the bottom of the groove, provided the roughness height rating and the spacing of the grooves both meet the allowed tolerance for accuracy.

To be of any permanent value, reference specimens should be made of such a material that repeated measurements on their surfaces can be made

Fig. 14. Profile of precision reference specimen.

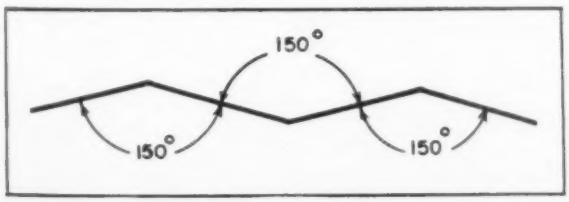


Fig. 5. Roughness height.

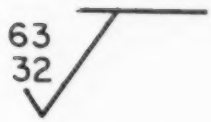


Fig. 6. Roughness range.

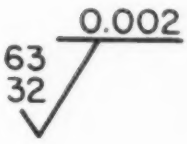


Fig. 7. Waviness height.

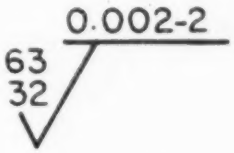


Fig. 8. Waviness width.

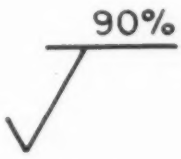


Fig. 9. Contact area.

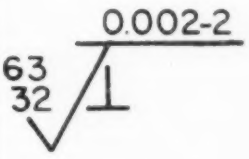


Fig. 10. Lay designation.

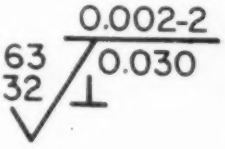


Fig. 11. Cutoff rating.

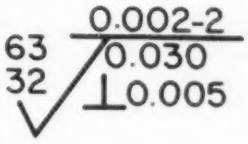


Fig. 12. Roughness width.

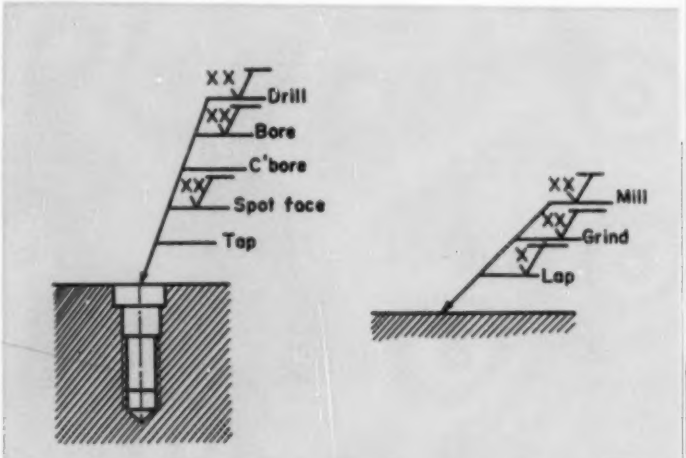


Fig. 13. Roughness control of several operations.

without loss of accuracy. Roughness values of these specimens should not vary from the designated value by more than 1 microinch or 3 percent, whichever is larger. The average spacing of the grooves of the specimens should be within 2 percent or 20 microinches, whichever is smaller, of the theoretical spacing corresponding to the nominal roughness height.

Average deviation of roughness height of individual grooves of any specimen should not exceed 4 percent of the total roughness height. The average deviation of the groove spacings on a given specimen should not exceed 3 percent of the average spacing.

Comparison Specimens: Surfaces having the characteristics of typical machined surfaces may be evaluated by visual or tactual comparison with roughness comparison specimens. These specimens are described by type of machining, lay, roughness height, feed and roughness-width cutoff, TABLE 4. Because their use does not involve wear, comparison specimens can be made of any metal that will have the characteristics of a machined material.

Roughness Averages: The mean line about which roughness is measured is a line parallel to the general direction of the profile throughout the roughness-width cutoff length. Sums of the areas contained between the mean line and those parts of the profile which lie on either side of it are equal. An approximation of the average roughness may be obtained by adding the vertical increments, *Fig.* 15, without regard to sign and dividing by the number of increments taken. For the illustrated profile the total is 146 and there are 22 increments. The roughness average would therefore be 6.64 microinches.

This method of determining the average deviation results in an arithmetical average, which can be abbreviated as "AA." The unit "microinch" can be abbreviated as μ in. or MU in. The arithmetical average is now being proposed as the preferred roughness indicator.

However, many instruments now in use determine averages by the root mean square method. By this method, the squares of all the increments are added and this sum is divided by the number of increments. The square root of this value is the roughness measurement, "RMS." for the profile in *Fig.* 15, the root mean square average is 7.37 in.. RMS.

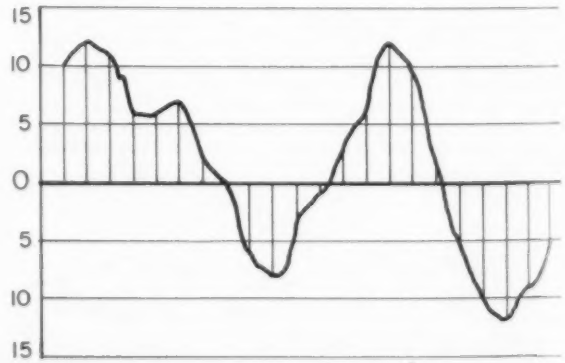
Roughness measuring instruments calibrated for root mean square average read about 11 percent higher on a given surface than those calibrated for arithmetic average. This difference is in such a direction that continued use of drawings that specify roughness in root mean square averages with instruments calibrated to arithmetical average would allow the acceptance of surfaces up to 11 percent greater in roughness than intended. This difference, however, is of lesser magnitude than the variations from point to point on a machined surface and is considerably less than the variation expected from one piece to another. Many manufacturers consider it practical to adopt arithmetical average ratings without changing the roughness values on previous part drawings.

These reference sheets have presented some of the broader aspects of standards for surface roughness, waviness and lay. Future reference sheets will go into greater detail on specific points and equipment design.

Table 4—Physical Specimens of Surface Roughness and Lay

Type of Surface	Roughness Height (μ in.)	Lay	Feed (inch)	Minimum Roughness-Width Cutoff (inch)
Honed, lapped or polished	2	Parallel to long dimension	...	0.030
	4		...	0.030
	8		...	0.030
Ground with periphery or wheel	4	Parallel to long dimension	...	0.030
	8		...	0.030
	16		...	0.030
	32		...	0.030
	63		...	0.030
Ground with flat side of wheel	4	Angular in both directions	...	0.030
	8		...	0.030
	16		...	0.030
	32		...	0.030
	63		...	0.030
Shaped or turned	32	Parallel to long dimension	0.002	0.030
	63		0.005	0.030
	125		0.010	0.030
	250		0.020	0.100
	500		0.030	0.100
Side milled, end milled or profiled	63	Circular	0.010	0.030
	125		0.020	0.100
	250	Angular in both directions	0.100	0.300
	500		0.100	0.300
Milled with periphery of cutter	63	Parallel to short dimension	0.050	0.300
	125		0.075	0.300
	250		0.125	1.000
	500		0.250	1.000

Fig. 15. Representative profile showing increments about mean line.



NEWS

santa greets
a sober little miss
at baltimore's christmas party
. . . . . see page 136

DECEMBER 1955

featured this month

Directors Meet in Detroit 129
"Tooling for Tomorrow" to Keynote Exposition 132
Wentworth Institute Chapter 134
Open Another Door to Opportunity! 135
Baltimore Members Say 'Merry Christmas' 136
Education Awards Announced for 1956 138
Arthur Colton Joins *The Tool Engineer* Staff 139
National Standards Committee 139
Positions Available and Wanted 140
Area Membership Meeting 142
Coming Meetings 148

chapter news

Alfred State Tech 141
Baltimore 136, 139
Battle Creek 146
Binghamton 141
Boston 134
Calumet Area 143
Chautauqua-Warren 142
Chicago 143
Des Moines 140
Erie 145
Evansville 144
Fond du Lac 142
Fox River Valley 143
Golden Gate 149
Grand River Valley 149
Granite State 149
Greater New York 142
Hamilton District 144
Hendrick Hudson 144
Houston 145
Jackson 141
Lehigh Valley 141
Lima 141
Little Rhody 138
Long Beach 145
Los Alamos 140
Los Angeles 146
Louis Joliet 146
Louisville 141
Merrimack Valley 141
Mid-Hudson 139
Monadnock 142
Nashville 141
Nebraska 141
New Haven 144
New Orleans 147
Niagara District 148
Northern New Jersey 145
Northwestern Pennsylvania 146
Peoria 147
Piedmont 139
Pittsburgh 147
Portland, Ore. 142
Potomac 143
Purdue University 147
Racine 143
San Antonio 149
San Fernando Valley 148
Santa Clara Valley 140
Seattle 149
South Bend 143
Southeastern Massachusetts 147
Springfield, Ohio 145
Syracuse 140
Toledo 147
Tri-Cities 149
Twin Cities 146
Twin States 139
University of Kansas 146
Wentworth Institute 134
Western Michigan 146
Western Reserve 144
Windsor 144
Worcester 144, 148

Participating in the semiannual meeting, seated at the table, from left, were: A. R. Putnam, H. E. Collins, H. C. McMillen, H. B. Osborn, H. E. Conrad, G. A. Goodwin and J. P. Crosby. Standing were: J. X. Ryneska, H. D. Long, R. A. Smith, Wayne Ewing, A. B. Clark, J. O. Horne, W. G. Ehrhardt, William Moreland, R. C. W. Peterson and C. M. Smillie.

Directors meet in Detroit

Elect J. R. Weaver to Research Fund
Install New Board Members
Review Committee Reports

An intensified effort to better serve industry, the tool engineering field and its own members characterized ASTE's Board of Directors semiannual meeting in Detroit. Under the chairmanship of Harry B. Osborn, Jr., national ASTE president, sessions opened on Oct. 28 at the Statler Hotel.

Traditionally, semi annual meetings of the Board revolve around the review of national committee reports and recommendations by the House of Delegates, as well as approval of programs and projects for the coming year.

In addition, the 1955-56 Board elected a new member to the Research Fund Committee, re-elected Research Chairman Robert B. Douglas for another year, and approved an immediate appropriation of $50,000 for continuance of research activities.

James R. Weaver, the new member of the Research Committee, was also named vice chairman of the group. Manager of manufacturing and engineering at Westinghouse Electric Corp., Springfield, Mass., Mr. Weaver served as ASTE president in 1939-40.

One of the first items on the agenda was the swearing in of three new directors, elected last March by the House of Delegates. Installed by President Osborn were: William Moreland of Ashland, Ohio; Raymond C. W. Peterson of Toledo; and William A. Thomas of Windsor, Ont.

A revised Constitution and By-Laws which has

(Continued on next page)

Board Meeting

President Osborn, left, installs Raymond C. W. Peterson, center, and William Moreland as members of the Board. New Director W. A. Thomas was not present for the picture. Harry E. Conrad, executive secretary of ASTE; and George A. Goodwin, Board member, are also shown.

Sitting in at the meeting were: from left, W. F. Wagner, Honor Awards chairman; Fred Kampmeier, Finance chairman; Robert Douglas, Research chairman; Ray Morris, Progress chairman; Vincent Spahr, Constitution and By-Laws chairman; and I. F. Holland, Parliamentarian.

been under the study and consideration of the National Constitution and By-Laws Committees for three years, was sanctioned by the Board. Both documents have been reworked and made more usable.

The articles and section system has been adopted for more efficient indexing and easier reference. While it is within the jurisdiction of the Board to approve the By-Laws changes, the revised Constitution must be put before the membership for referendum vote. Each Society member will be getting a copy of the revised Constitution and will be asked for his vote by mail ballot before the Annual Meeting in 1956.

An addition to the chapter procedures will be a calendar, specifying the functions, necessary reports and persons responsible for each duty at the chapter level, outlined by months.

A proposed annually dated membership certificate suitable for framing, suggested by the National Membership Committee, will be referred by the Board to the National Delegates for their reaction.

On recommendation of the Progress Committee, the Board voted to study what further service ASTE can provide individual members and industry as a whole. This requires comparing ASTE services with those of other engineering associations and societies.

The Progress Committee also strongly advised that another National Leadership Conference, as introduced to the Society in 1953, be planned. The Board, recognizing the value of this communication with chapter officials, asked the ASTE officers to work on the project.

Another action of the Board approved establishment of two new awards by the National Honor Awards Committee. The ASTE Education Award for meritorious service in the field of education and ASTE Research Medal will be for scientific accomplishments in research which will benefit the field of tool engineering.

In view of the long-range, accelerated publishing program proposed by the National Book Committee, the Board approved expansion of the entire operation. In line with this, book committees will become an integral part of each chapter's organization, implementing the national activity.

Upon recommendation by the House of Delegates last March, the Board ruled that dues notices will be mailed to members before the month that membership expires. This will give members additional time to remit payment and help them stay off the delinquent list.

The Board heartily approved continuation of the ambitious program of on-campus conferences, and education awards being carried on by the National Education Committee. Scholarship awards of $700 each again will be given to outstanding engineer-

ng students throughout the United States and Canada.

A revised and enlarged edition of the present numerical index for ASTE Data Sheets, project of the National Standards Committee, got special attention and approval by the Board. It will be going out to the entire membership in the near future.

A committee was elected by the Board to nominate candidates for the Board of Directors next year. Joseph P. Crosby, immediate past president of the Society, will be chairman of the group. Serving with him will be: Ben J. Hazewinkel, H. Dale Long, James O. Horne, Andrew B. Clark, and Raymond C. W. Peterson.

President Osborn also appointed the nominating committee for next year's officers. It consists of Joseph P. Crosby, chairman, George A. Goodwin and William Moreland.

An innovation at the meeting was the premier showing and use of the Meeting Monitor, devised and constructed by Allan Ray Putnam, ASTE assistant executive secretary. Resembling a big switchboard, it has lights which indicate what stage a motion or proposal is in and helped keep the meeting going according to Roberts Rules of Order.

The 1955-56 semiannual meeting wound up with a banquet at the Statler attended by officers, directors and national committee chairmen. One of the highlights of the evening was a film on wildlife narrated by Ben East, field editor for *Outdoor Life* magazine.

ASTE Past President Named to Research Fund Committee

James R. Weaver, elected to the Research Fund Committee by the Board of Directors, is no newcomer to the ASTE scene. A member of the Society for nearly 20 years, he served as president and chairman of the Board in 1939-40. He is now affiliated with the ASTE chapter at Springfield, Mass., where he is manager of manufacturing and engineering for Westinghouse Electric Corp.

Mr. Weaver has 40 years of industrial experience to his credit. He began his engineering career in 1915 at Westinghouse, and held varied positions at the East Pittsburgh Works, including those of: director of equipment, inspection and testing; superintendent of manufacturing equipment; and works mechanical engineer.

During World War II, he managed two ordnance plants, one at Louisville, Ky., and one at Centerline, Mich. More recently, Mr. Weaver served as vice president at Baldwin-Lima-Hamilton Locomotive Corp. In 1952 he was appointed to his present position at Westinghouse.

Very active in civic affairs, he is an officer of numerous organizations and is also a member of ASME.

Listening intently to deliberations by the Board, national committee chairmen are: from left, W. B. Wells, Public Relations; P. R. Marsilius, Program; J. L. Petz, Editorial; J. E. Rotchford, vice chairman of Standards, who sat in for Board member and chairman, William Moreland; R. E. McKee, Education; L. C. Seager, Professional Engineering; and T. B. Carpenter, Judicial.

Chicago, second largest city in the nation, will be host on March 19-23 to ASTE's 1956 Industrial Exposition.

"tooling for tomorrow"

to keynote ASTE's 1956 industrial exposition

TREMENDOUS STRIDES in production tool and accessory design, slated for "full dress parade" at ASTE's forthcoming Industrial Exposition, are best described by the 1956 show theme—"Tooling for Tomorrow." The theme will also keynote the extensive program of technical papers and plant tours scheduled during convention week, March 19-23, in Chicago.

In announcing the theme, Executive Secretary Harry E. Conrad pointed out that technological changes are coming about so rapidly, tooling concepts must keep pace. A thorough review of present tooling facilities is, more than ever, a real necessity.

Today's tool engineer must not become complacent, Mr. Conrad said. He must maintain a dynamic viewpoint, continually examining all of the new developments. With more than 450 exhibits, ASTE's Exposition will provide the display case for ideas so that current tools, with known results, can be compared with the "Tooling for Tomorrow."

The five days of convention week have been specially designated to point up particular features of the integrated technical program. General topics are: New Materials, Mar. 19; Research, Mar. 22; New Processes, Mar. 21; Management, Mar. 22; and Tool Engineering, Mar. 23.

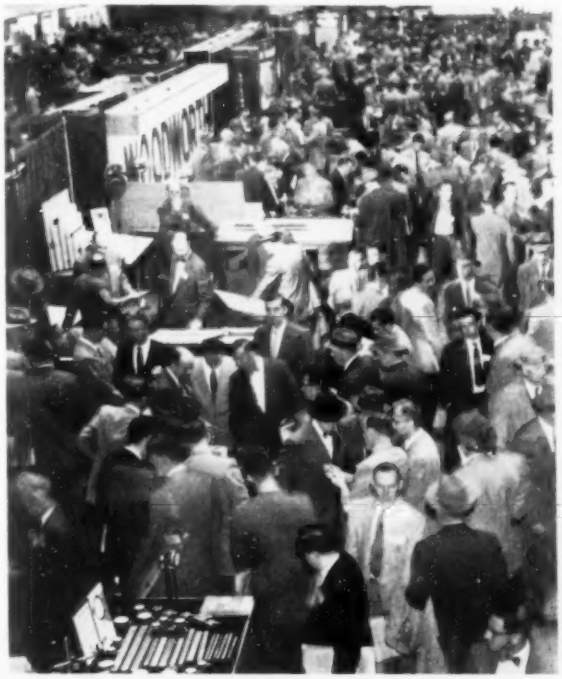
Technical sessions will find more than 60 of the nation's leading executives and engineers addressing ASTE audiences. A schedule of tours at 12 companies in the Chicago area has been lined up to give "on-the-spot" information on industrial operations.

Never before offered on an ASTE national program, a symposium on industrial diamonds will be one of the highlights of the 1956 convention. Co-sponsored by the Society and Armour Research Foundation of Illinois Institute of Technology, the symposium will be held March 19-21.

Papers on the making, use, and standards of diamond tools are to be presented by experts from the United States, Europe and South Africa. An actual operating diamond workshop and a diamond display worth more than one million dollars will be special features.

Two other organizations will be participating in the technical program as co-sponsors. Covering the material, design and use of expensive carbide dies, one session entitled "Solving Carbide Die Problems" will be offered by speakers representing the National Tool & Die Manufacturers Association. Another conference on fluid power will be presented through the sponsorship of the National Fluid Power Association.

Market place for advanced ideas of the latest in tooling, the ASTE Exposition will be held in the world's largest convention hall, Chicago's International Amphitheatre.



John X. Ryneska, second from left, national ASTE secretary, presents the charter to Robert Cusson, Wentworth student chairman. From left are: Marvin Bunting, ASTE staff administrator; Mr. Cusson; Charles Moody, Boston education chairman; J. Joseph Tansey, Wentworth Director of Students; Secretary Ryneska; and Arthur F. Gould, member of the ASTE National Education Committee.

Wentworth Institute Chapter

By Melvin P. Burns
Editorial Chairman, Boston Chapter

Highlight on the Boston ASTE calendar for October was the chartering of the Wentworth student chapter #7. More than 250 were present when the Boston chapter joined the students at the Institute and held its Oct. 31 meeting in conjunction with the ceremonies.

The charter for Wentworth was approved last May at the end of the school year, but, because at that time students are traditionally deep in studies for final examinations, official chartering ceremonies were postponed until this fall.

John X. Ryneska, national ASTE secretary, presented the charter on behalf of the Society to Robert A. Cusson, Wentworth student chairman.

Special guests who paid tribute to the new student chapter were: Prof. Arthur F. Gould of Lehigh University, member of the ASTE National Education Committee; Marvin Bunting, ASTE staff administrator from National Headquarters; and J. Joseph Tansey, Wentworth Director of Students, who extended welcome on behalf of Wentworth Institute President H. Russell Beatty. Mr. Tansey also gave a brief talk on the history, educational opportunities and objectives of Wentworth Institute.

Other officers of the 65-members student chapter are: Linwood A. Pickle, first vice chairman; Arthur A. Shaw, second vice chairman; Robert Allison, Jr., secretary; and N. D. Raftopoulos, treasurer.

The Boston chapter staged its planned technical program which featured a talk on "Hydrospinning." Speaker was George L. Beatty, engineer on Hydroform and Hydrospin machines at Cincinnati Milling Machine Co. Past Chairman Arthur A. Nichols was the coffee speaker.

The business session saw the appointments of Nicholas W. Juliani, former program chairman to fill the vacated secretary's position, Charles H. Sylvain to fill the post of public relations committee chairman, and Melvin P. Burns to the post of editorial chairman.

open another door to opportunity!

By H. Verne Loeppert
Chairman, National Membership Committee

ASTE membership has doubled and redoubled many times since the Society was founded back in 1932. From that small group of founders who first realized the need for an American Society of Tool Engineers, membership has risen steadily through the years—all the time keeping pace with the great strides recorded by ASTE in technical growth and development.

Today, the Society's official roster lists 130 senior chapters, 11 student chapters and more than 32,000 members.

All this may mean little to you as an individual member. However, it does point up rather dramatically the fact that thousands of tool engineers like yourself want what the Society has to offer.

While ASTE offers much in the way of services—what you *get* depends on you!

The "dividend" from your membership depends upon your investment of time and talent.

Not only go to the meetings of your chapter—*participate!* Get to know more members, and so increase your exchange of ideas. If you're not already on a committee and have the time to devote, let your chairman know about your desire to serve your chapter.

Interest prospective members in ASTE by taking them to a meeting and showing them how the Society makes available the technical information they need through: chapter technical sessions; the pages of THE TOOL ENGINEER; data sheets; *Tool Engineers Handbook; Die Design Handbook;* and the ASTE on-campus conferences and national industrial expositions and annual meetings.

By taking a more active part in chapter functions, you'll be opening another door to opportunity—opportunity to be a leader, to become better known among men active in various phases of technical administrative work, and to gain additional experience and recognition in working with people.

Success on the job, generally speaking, comes to the man who has demonstrated he hasn't stopped learning, and who proves his proficiency in the field of human relations as well as in engineering skill. Active membership in ASTE can help you prove all three!

Santa's question "What do you want for Christmas?" gets serious attention from a four-year-old guest at last year's party staged by Baltimore chapter

Baltimore members say—

Merry Christmas

to their boys and girls

Adults, too, joined in the fun and festivities . . . giving Santa a hand is Dick Coleman, '54-55 chapter chairman

Past Chairman Don Wernz as Santa Claus interviewed more than 50 children and gave each a stocking full of goodies

'Felix the Cat' films and the skill of a professional magician delighted everyone

EDUCATION AWARDS

In keeping with the tradition of fostering tool engineering education on the college level, the American Society of Tool Engineers announces the 1956 International Education Awards. Scholarship money totaling $7000 will be presented next year by the Society to outstanding engineering students in recognized schools in the United States and Canada. Ten awards of $700 each will be made in this, the sixth such annual event.

Winners will be announced next March during the week of the Annual Meeting, March 19-23, in Chicago. Members of the ASTE National Education Committee, headed by Prof. Robert E. McKee of the University of Michigan, will act as judges.

To be eligible for awards, students must be taking full-time courses in preparation for future work in tool and production engineering.

Candidates will be judged on the basis of scholastic standing, faculty recommendations, evidenced interest in tool production engineering, extra curricula activities and honors, past experience and need.

All ASTE members are urged to encourage engineering students in their chapter areas to apply. Posters, announcing the awards, have been mailed from ASTE National Headquarters to all chapter education chairmen. The National Education Committee is quite anxious for each education chairman to see personally that these announcements are posted on school engineering building bulletin boards.

Applications are available either from the deans of engineering schools or by writing to the ASTE National Education Committee, 10700 Puritan Ave., Detroit 38, Mich. All applications, together with letters of recommendation must be mailed so that they will arrive at the above address no later than Feb. 15.

Methods of precision casting were discussed at a recent Little Rhody meeting by H. J. Dixon, who has been associated with the field of metallurgy for more than 25 years. Shown here, from left: Robert Seaberg, D. A. Turnquist, Al Dion and Ben Larson. Frank DeLucia is partially hidden from view.
—Richard Kilbane

Twin States Chapter Holds Annual Outing

Despite a prevailing rain, more than 100 members and guests of the Twin States chapter enjoyed the annual outing held at Crown Point Country Club, Springfield, Vt., on Sept. 24.

A score of foursomes braved the rain for eighteen holes of golf and others engaged in plug casting, archery, putting and chipping contests. An archery exhibition was staged by Vermont Champion Skitchewaug Bowman.

Noontime lunch consisted of clam chowder and cold cuts and dinner included one-pound charcoal broiled steaks.

—Maurice E. Blair

Piedmont Chapter Meets With ASM Members

A program on European manufacturing methods was presented Oct. 13 at a joint meeting of ASTE and ASM members in the Piedmont chapter area. Speaking to the group of 80 was Albert R. Fairchild, metallurgical engineer at Western Electric.

He compared production operations in Europe with those in the United States and also placed great emphasis on the apprentice system employed abroad. The program was a 'repeat' of the one given two days earlier before members of the Raleigh-Durham subsection of Piedmont chapter.

—Howard Longfellow

Two Speakers Heard at Mid-Hudson Meeting

Principal speaker at the Mid-Hudson chapter's Oct. 11 meeting was Frank E. Chase. Mr. Chase, New York district manager for Consolidated Engineering Corp., presented a program on "Machine Tools and Vibration" and showed a colored film entitled "Dynamic Measurement."

Coffee speaker was George Sinden, factory representative for the Elox Corp., who showed a colored film on "Electrical Discharge Machining" and answered questions on the machine.

—Davis Gale

Elmer Syrene Appointed

Appointment of Elmer Syrene as special projects engineer is announced by Erickson Tool Co. Previously associated with E. Westberg Corp., Mr. Syrene is a member of the Syracuse ASTE chapter.

ASTE's National Standards Committee met recently to review the tentative standard on single point carbide tools written by the carbide subcommittee as an addition to ASA standard B5.22. Approval was given the draft for submittal to B5. Pictured here, from left, are: George F. Bryan; F. J. Geoffroy; A. M. Johnson; J. E. Rotchford, vice chairman of the committee; William Moreland, chairman of the committee and an ASTE national director; G. M. Hargreaves, staff administrator; C. L. Fanning; Dean Saurenman; H. J. Moffatt; and A. E. Crom (with back to camera).

Baltimore Members Tour Western Electric Plants

A group of nearly 100 Baltimore chapter members visited the Point Breeze Works of the Western Electric Co. in Baltimore on Oct. 5. Arranged by Program Chairman Jim Rodgers, the tour included the cable, insulated wire, and electroforming buildings where the visitors witness the manufacturing of various electric products and the application of the tools pertinent to their manufacture.

The members received a cordial welcome to Western Electric from B. A. Raetsch, assistant superintendent for the manufacturing engineering division. The tour was concluded with the serving of refreshments. *—Raymond T. Crew*

Quiz Corrections

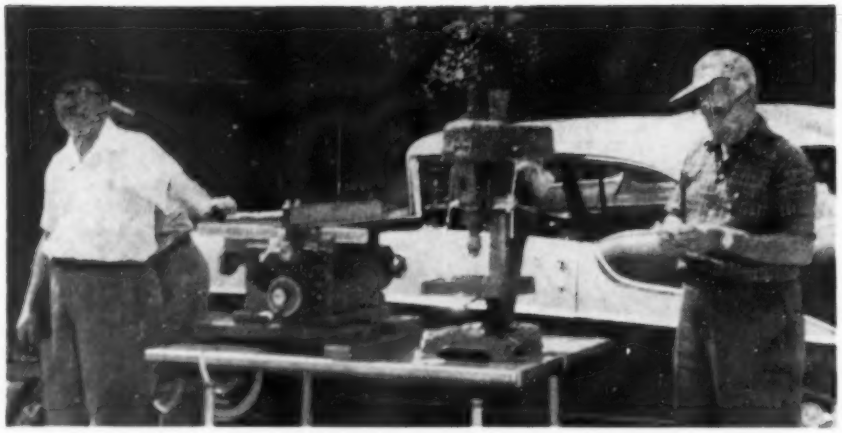
In the professional examination question answers listed on page 139, October 1955, several errors appeared. Correct answers are:

2. (b) 4.04 inches
4. 1928 lb-ft
6. 19.8 oz

Arthur Colton Joins *The Tool Engineer* Staff

Appointment of Arthur Colton to the editorial staff of THE TOOL ENGINEER has been announced by Editor John W. Greve. Mr. Colton has been named assistant editor, succeeding Alfred K. Abbott who resigned to join the publication staff of Plymouth Div., Chrysler Corp. Before joining the staff of ASTE's official publication, Mr. Colton was associated with the following firms: Arthur Colton Co., as engineering coordinator; R. P. Scherer Corp., as engineering sales consultant; and American Machine Products, office manager and engineering advisor. Most recently he had been with the Berkley Tool Co. as secretary, director and general manager. Mr. Colton studied mechanical and chemical engineering at the Michigan College of Mining and Technology.

Mr. Colton



SYRACUSE—A record attendance of 720 members and guests turned out for the annual clambake. Lester Collins, left, and Herb Mozeen were in charge of the event, as they have been for the past 18 years. Receipts from the clambake, together with returns from tickets for the grand prize, are used to finance the scholarship fund. The fund is maintained to finance a four-year scholarship for a deserving Syracuse area high school student who wants to study tool engineering at an accredited university. *—Paul H. Hansel*

Des Moines Observes Sixth Anniversary

More than 100 members and their wives were present to help celebrate Des Moines chapter's sixth anniversary on October 19 at Hotel Savery. After a banquet, Lauren K. Soth, editor of the editorial pages for the *Des Moines Register and Tribune*, was the speaker.

Having returned from a tour of the Soviet Union with the American Farm Delegation last summer, Mr. Soth gave a report on the Soviets. It was he who, through the editorial pages of his paper, first suggested the exchange of farm leaders in the two countries. An amateur magician and an organist provided additional entertainment.

On Sept. 21, chapter members heard James J. Mudd, assistant manager of field engineers and sales for The Bellows Co. The movie, "Operation Pushbutton" was also shown at this meeting at Hotel Kirkwood. *—John Willing*

Santa Clara Members Visit Ames Wind Tunnel

A trip to Moffet Field to see a demonstration of the Ames transonic wind tunnel was made in September by more than 100 members and guests of Santa Clara Valley chapter. Also demonstrated was the material and equipment used by crews at Ames in experimental development.

Welcoming the group was D. S. Wentz, aeronautical information specialist, National Advisory Committee for Aeronautics, Ames Aeronautical Laboratory. Acting as guides for the tour were: Raymond E. Braig, George E. Bulifant, John D. Morris, John P. Houston and William Ward.

—William H. Forbes

New Post for A. J. Derrick

According to a recent announcement by F. O. Reedy, president of Kennedy-Van Saun Mfg. & Eng. Corp., Danville, Penn., Anthony J. Derrick has been appointed manager of the firm's foundry department. A member of Paterson ASTE chapter, Mr. Derrick will be in charge of production and sales in his new position.

Philip C. Wood Named Factory Manager

Promotion of Philip C. Wood to factory manager of The Acklin Stamping Co. has been announced by Alvin E. Seeman, company president. Mr. Wood, a member of the Toledo ASTE chapter, joined Acklin in 1942 as a metallurgist, and has since served as estimator, assistant to the vice president, chief engineer and assistant factory manager.

J. R. Lilienthal Heard At Los Alamos Meeting

"The History and Development of Remote Control Mechanisms" was the subject under discussion at Los Alamos chapter's September meeting. Technical speaker was James R. Lilienthal of the University of California staff at Los Alamos.

He explained how hydraulic and pneumatic apparatus; electrical controls, motors and computers; gyroscopes and servo-mechanisms are all included in the general subject of remote control mechanisms. These mechanisms are used to handle 'hot' or radioactive material, and also play an indispensable part in the automation of American industry. *—Eugene Roach*

Position Wanted

PAST CHAIRMAN CANADIAN CHAPTER—age 39, widely connected with a successful background of 18 years in manufacturing administration and industrial relations. Present position works manager. Previously acted successfully as industrial sales manager, production manager, project development engineer, purchasing and tool engineer. Desires challenging position of responsibility with progressive organization in Canada or the United States. Write to Box 061, News Department, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

Positions Available

MANUFACTURING ENGINEER—graduate M. E. Know mass production of small sheet metal parts and assemblies. Experienced in cost reduction analysis and procedures. Provide cost estimates to include tooling, fabricating outputs, machine selection on new and current projects. Be capable of suggesting design changes resulting from review of manufacturing tolerances, drawing dimension and related functions of parts. This is an excellent opportunity with a progressive organization. Include detailed resume and salary requirements in first letter to Schlage Lock Co., P. O. Box 3324, San Francisco 19, Calif.

MANUFACTURER'S REPRESENTATIVE—young growing manufacturer of perishable stores item needs additional sales representation. Generous commission and exclusive contract offer continuous substantial earnings. Several territories open. Experience selling cutting tools or similar item necessary. Write fully in strict confidence to Box 062, News Department, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

ASST. CHIEF PRODUCTION ENGR.—capable of eventually handling top spot in old established metal products company. Must have experience in designing for manufacturing and assembly of small parts. Engineering degree not essential. No age limits for qualified applicants. Write to Box 059, News Department, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

BUSINESS OPPORTUNITY—established tool and die plant, located in heart of Essex County, New Jersey, needs 35-50 year old shop superintendent and investor. Excellent growth opportunity for right man. Favorable terms. Write to Box 060, News Department, The Tool Engineer, 10700 Puritan Ave., Dertoit 38, Mich.

NEBRASKA—A smorgasbord dinner and a program of dancing were among the attractions at ladies' night held in September. "New Approaches to Ideas" was the subject of the featured speaker, Arthur C. Horricks, second from left, public relations counsel for Goodyear Tire & Rubber Co. Shown, from left, are: Sam L. Grasso, Mr. Horrocks, Mr. and Mrs. Forrest W. Conover, and Mr. and Mrs. Homer N. Leymaster. *—Dean W. Roper*

George L. Beatty Heard at Binghamton Meeting

Addressing some 80 members of Binghamton chapter, George L. Beatty, sales engineer with Cincinnati Milling Machine Co., was the featured speaker at the October meeting. He talked on "Hydroforming and Hydrospinning of Metals." His presentation was followed by a group discussion.—*Glyn Williams*

Alfred State Tech Holds Steak Roast

A steak roast launched fall activities of the Alfred State Tech student chapter. Held Sept. 27 at the Angelica Rod and Gun Club, the event offered an opportunity for members of the upper classes to meet first-year students. The program included dinner and energetic games of football, volleyball and horseshoes. *—Jo Ann Blanz*

JACKSON—A film on the theory of the honing process was shown Sept. 19 by representatives of Micromatic Hone Co. Pictured here, from left, are: D. T. Peden, vice president and chief research engineer; Glen Berry, chapter second vice chairman; and F. B. Weber, district sales manager.—*A. L. Holton*

Broaching Discussed By Lima Speaker

Harry H. Gotberg, vice president of Colonial Broach & Machine Co., was the featured speaker at the Oct. 20 meeting of Lima chapter. He spoke on "Broaching Methods and Application" and presented a film on the evolution of broaching.

Highlights of the movie included the progression of broaching methods from the time of its inception, and the utilization of mechanical and automatic techniques available for fabrication. *—Gene D. Stemen*

Nashville Chapter Holds Planning Meeting

Members of the Nashville chapter met at the B&W cafe on Oct. 11 for some long-range planning of activities. They decided to continue their chapter publication, which has been published for a year, and set up a committee to work on the forthcoming Christmas party. *—Bailey F. Moore*

Waldemar Naujoks Joins Drop Forging Association

The Drop Forging Association has announced the appointment of Waldemar Naujoks to their staff to head up the association's statistical program. Mr. Naujoks, a member of the Syracuse chapter of ASTE, was vice president of Globe Forge, Inc., Syracuse, N. Y., and is widely known throughout both the forging and metalworking industry for his papers and writings. He is an author of the *Tool Engineers Handbook* and has spoken before many ASTE chapters.

Crushed Wheel Grinding Discussed at Lehigh

Eighty members and friends of Lehigh Valley chapter heard J. C. Wilson speak on the development of crushed wheel grinding on Sept. 23 at the Hotel Traylor.

Mr. Wilson, chief engineer and sales manager for the Thompson Grinder Co., traced the history of crushed wheel grinding and, with the aid of a motion picture and slides, revealed the intricacies, limitations, cautions, and precautions of the process, including the proper use of coolants.

Guests present included: Charles Brogan, M. B. Henneberger, Donald Sterner, C. Frederick Pearson, George Cummings, A. C. Openshaw and C. W. Davisson, all of W. E. Shipley Machinery Co.

Other guests included: Peter Rakovitch of General Electric Co. and Dale Greene, eastern representative of Thompson Grinder Co.

—Chauncey R. Kay

James W. Dopp Addresses Merrimack Valley Meeting

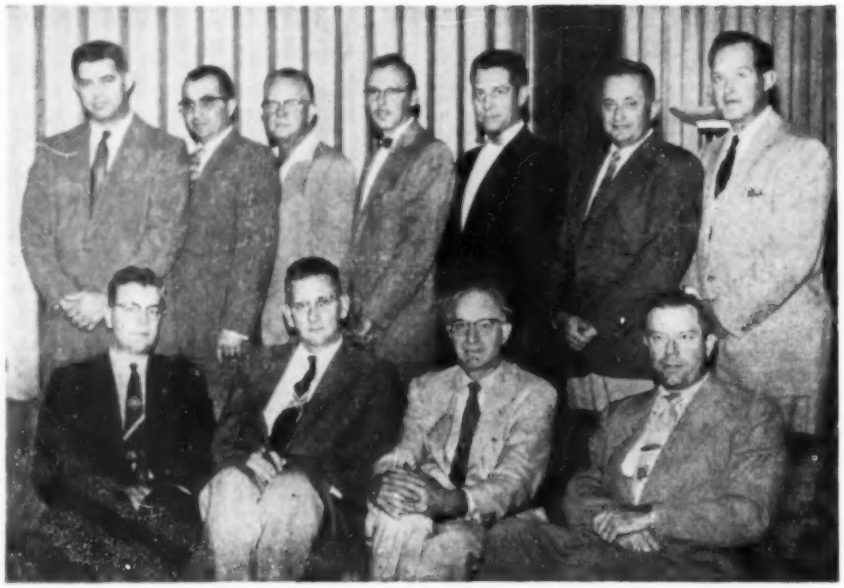
The development of broaching during the past 60 years was outlined at Merrimac Valley's October meeting by James W. Dopp, field service engineer, The Lapointe Machine Tool Co. in a discussion of "Electro-Mechanical Broaching." A color film illustrated some of the latest types of equipment developed by Lapointe. Technical chairman for the program was Alfred W. King who introduced the speaker to an audience of 50 members and guests meeting at the Greenridge Farm Restaurant at Nashua, N. H.

Mr. Dopp

—Arthur E. Clement

Aluminum Forming Topic at Louisville Meeting

"Case Histories in Aluminum Forming" was the subject of a talk delivered by E. V. Sharpnack, Sr. at the Oct. 11 meeting of the Louisville chapter. Some 60 members saw the movie on forming of aluminum beer barrels and heard Mr. Sharpnack's talk. He is chief forming engineer for the Reynolds Metals Co. *—Sam T. Gleaves*



"Chapter Membership Activities" was the principal topic of discussion at an area membership meeting held Sept. 3 at Dallas, Tex. It was one of the first sessions held as part of the National Membership Committee's expanded program to better serve chapter needs.

Taking part (front row, from left) were: Orville B. Strahm, secretary of the meeting and area lieutenant for the National Membership Committee; Louis E. Jaenecke, second vice chairman of North Texas chapter; Cecil R. Baker, Oklahoma chapter; and H. E. Shigley, education chairman, Wichita chapter.

Back row: Paul R. Hess, Wichita, second vice chairman; James H. Janson, Wichita chapter chairman; H. D. Gerrison, East Texas chairman; W. R. Kutschman, Wichita membership chairman; Fred Paris, East Texas membership chairman; Irving H. Buck, vice chairman of the National Membership Committee and chairman of the meeting; and Don McCord, North Texas membership chairman.

Frank Zagar Addresses Monadnock Meeting

A founder of Zagar Tool, Inc. and president of the company, Frank Zagar, was the technical speaker at the September meeting of Monadnock chapter. His subject was "Multiple Spindle Drilling and Jig Design."

Mr. Zagar emphasized the importance of correct jig and fixture design, outlining the basic principles of each. He also explained the advantage of his company's gearless drill heads. Second Vice Chairman James Franciscus introduced Mr. Zagar.

About 60 members and guests attended the dinner meeting at the cafeteria of Kingbury Machine Tool Corp.

—Maurice D. Towne

J. L. Lancaster Promoted

Rycenga Mfg. Co., Detroit, announced the appointment of J. T. Lancaster to the position of plant manager. Formerly manager of engineering, Mr. Lancaster is a member of the Detroit ASTE chapter. In his new post he will direct all production and engineering facilities.

Emanuel Lull Presents Program on Die-Casting

A group of 70 members of Chautauqua-Warren chapter were on hand Sept. 22 for a program on die-casting steels. A film and talk were presented by Emanuel E. Lull, chief sales engineer, Crucible Steel Co. of America, and also a member of ASTE's National Membership Committee which he serves as an area captain.

The film, "Die-Casting—How Else Would You Make It?" illustrated high production of complex designs, and Mr. Lull's discussion covered the development of special steels needed in die-casting dies. He stated that some of the problem of dies not functioning properly have been due to the lack of time to properly stress relieve the steel after removing a great amount of the original block of steel, and the lack of sufficient wall thickness to prevent the die from springing open when under molding pressure.

The meeting was held at the Masonic Temple in Jamestown.

—Walter Carlson

"The Transitor" Topic at Fond du Lac Meeting

A lecture and demonstration on "The Transitor" was presented before 90 members and guests of the Fond du Lac chapter on Oct. 14. Herbert Zwarra, supervising engineer of special services, Bell Telephone Co., Milwaukee, was the speaker. Robert Brechlin was in charge of reservations and made all the meeting arrangements for this meeting at the Elks Club in Appleton, Wis.

—Walter M. Gradolf

Portland, Ore., Speaker Talks on 'Hydrospinning'

A lecture and a series of slides on the 'Hydrospinning' process were presented Oct. 22 at a meeting of 44 Portland ASTE members. Speaker at the session was Charles R. Heimlich, field engineer with the Process Machinery Div., Cincinnati Milling and Grinding Machines, Inc. His discussion was followed by a lively question and answer period.

—Walter L. Brenneke

GREATER NEW YORK—Coffee speaker at the September meeting was Albert Butler, shown here, who discussed mechanics of body movement.

"Die Forgings" Discussed at New York Meeting

The current season of ASTE meetings was opened Sept. 12 with a technical session at the New York Times Building. About 110 members were present for the program on die forgings presented by Robert Merrill of Merrill Brothers, Maspeth, Long Island.

He showed a sound and color film produced for the Drop Forging Assoc. and also conducted a discussion on die designing problems and die forging techniques.

Coffee speaker was Albert Butler, president of the Dance Masters Assoc.

—Jean Nazeley

CALUMET AREA—Flanked here by chapter officers and committee chairmen, National President Harry B. Osborn, Jr., sixth from left, was guest of honor at the first annual golf outing staged at Turkey Creek Country Club. About 200 attended the event. Also pictured are, from left: E. W. Menke, Wayne T. Bates, C. M. Dillon, Dave S. Lambie, E. A. Morgan, Dr. Osborn, John T. Djenka, C. E. Chapman, Emil E. Sobilo and Les Thill.—*E. E. Sobilo*

E. W. Dickett Addresses Calumet ASTE Members

"Machine Tools and the Tool Engineer" was the title of the discussion presented for the members of the Calumet Area chapter at the Oct. 10 meeting. Program speaker was E. W. Dickett of Sundstrand Machine Tool Co.

Mr. Dickett stressed the importance of preliminary operations, such as "center drilling" and machining of locating pads on parts to be manufactured. He stated that many difficulties encountered in product fabrication could be traced back to improper machining in the early stages. A film was shown illustrating the magnetic principle, construction and many uses of magnetic holding devices.

The lively question and answer session was conducted by Robert Hughes, also of Sundstrand Machine Tool Co.

—*L. W. Montgomery*

Two Managers Named

Einar A. Hanson, president of Hanson-Whitney Co., Division of Whitney Chain Co., has announced the appointment of B. W. Swanson as general manager and R. W. Grady as sales manager of Small Tools. Both are members of the Hartford chapter.

Milwaukee Chairman Elected President

Stephen Pohlhammer, chairman of the Milwaukee ASTE chapter, has been elected president of Northwest Tool Engineering Co. and Wisconsin Drill Head Co., machine tool manufacturers.

"Carbide Tool Usage" Topic at Fox River

Present carbide tool practice and suggested ways of increasing tool life were reviewed at the Sept. 27 meeting of Fox River Chapter.

Speaker at the session was Charles Demmitt, sales and service engineer with Kennametal, Inc., who addressed more than 50 members and guests. The meeting was held at St. Charles Veterans' Club.

Announcement was made that the chapter sponsored course in basic metallurgy is well under way and proving to be quite popular. —*H. L. Smith*

Full Agenda Greets Racine Members

Two different phases of activities greeted the 100 Racine members who turned out for their October meeting. The program opened with a plant tour at the J. I. Case Co. tractor plant where they visited the new Case 400 machining and assembly lines. Of particular interest was the automatic machines for drilling, boring, reaming and milling of the motor blocks and transmission housings.

While at Case, members also toured the tractor assembly line and watched the completed tractor being checked and run in. Master Mechanic Emil Schneebeli and ASTE members Robert Luxem, Harvey Zimmerman and Raymond La Fave acted as guides.

Following the visitation, the monthly dinner meeting was held at Danish Brotherhood Hall. Speaker was Dale F. Hansman, secretary-manager of the Racine Chamber of Commerce. He talked on "The Future of Racine's Industry."

—*Alvin J. Michna*

Tool History Revealed at Chicago Meeting

Tool development and human progress in the last million years was reviewed by the Chicago chapter at its Oct. 10 meeting at Nielsen's Restaurant. Some 75 members attended to see "Civilization through Tools," the exhibit sponsored by DoAll Co.

—*L. B. Klemme*

SOUTH BEND—A plant tour of Bendix Products Div., Bendix Aviation Corp., was on the September meeting agenda for 145 South Bend members and guests. Principal products seen in the manufacturing process were automotive brakes and power steering units, and aircraft landing, gear and fuel systems. Preceding the visitation, A. J. Walsh, master mechanic at Bendix, gave a short talk on the history of the company and what would be seen on the tour.—*David Herring*

EVANSVILLE—"Forging and Casting of Tool Steels" was discussed at the October meeting by Walter E. Peterson, second from right, manager, Forging and Casting Div., Allegheny Ludlum Steel Corp. After his talk, Mr. Peterson showed a film which pictured a modern steel mill in operation and described the influence of steel on modern day living. Shown here, from left, are Joseph Halbig, program chairman, and Ervin Beatty, Arnold W. Nelson, Mr. Peterson and Walter W. Armstead, Jr. —*W. H. Brooks*

WINDSOR—Automobiles of the future were discussed by Charles Eder, center, chief inspector at the North Plant of General Motors of Canada, Ltd., when he addressed the Sept. 12 ASTE meeting. Shown here with Mr. Eder are Phil Rudge, left, and E. I. Clifton, first vice chairman.—*F. D. Rail*

E. V. Crane Addresses Hamilton Members

E. V. Crane, chief development engineer for the E. W. Bliss Co., spoke before an audience of 112 Hamilton chapter members on Oct. 14. Illustrating his talk by film and slides, Mr. Crane discussed progressive and transfer die operations in automatic presses.

He also showed presses using automatically fed blanks and those using strip stock as well as safety devices incorporated in the machines.

On the special guest list was James O. Horne, national ASTE director, who presented a past director's pin to Bill Dawson, charter chairman of the Hamilton chapter and once national assistant secretary-treasurer of the Society.

—*William Marcellus*

New Haven ASTE Chapter Has Large Turnout Despite Two Floods

A turnout of 150 was particularly gratifying for the Oct. 11 meeting of the New Haven chapter in view of the fact that the area had been twice hit by devastating floods within two months. Even a large delegation from Waterbury, one of the hardest hit sections, was on hand.

Held at Crucible Steel Co. of America in North Haven, the meeting featured a talk by Clayton K. Baer, assistant sales manager of Crucible Steel. His "Tool Steel Clinic" discussion revolved around rolling, extruding and forging dies. Technical chairman was Al Pollard.

The meeting followed a buffet supper provided by Crucible Steel. Special guest at the event was Raymond Gifford, an early past chairman, who traveled all the way from Vermont to attend.

—*Silas W. Becroft*

P. O. Wernicke Named Sales Manager

Paul O. Wernicke has been named sales manager of the Machine Tool Division of Mercury Engineering Corp., Milwaukee. Mr. Wernicke, a member of the Milwaukee ASTE chapter, was formerly vice president and chief engineer of the Stokerunit Corp. and became general manager of this company after it was sold in March 1953 and renamed Simplex Machine Tool Corp.

Engineering Professor Speaks on Atomic Power

Hendrick Hudson members met Oct. 19 for a discussion on "Tool Engineering in the Atomic Age." Speaking to the group was Dr. V. Lawrence Parsegian, chairman of the engineering group and professor of nuclear engineering at Rensselaer Polytechnic Institute. He outlined the basic principles in mining uranium, setting up atomic reactors, and difficulties in maintaining and operating same. Dr. Parsegian also discussed the uses of radioactive materials in testing surfaces and told of the great areas for research in medicine, agriculture and industry.

Dr. Parsegian

Special guests attending the meeting at Circle Inn included: Col. Elmo Matthews, commanding officer of the Watervliet Arsenal; and Lt. Col. Burkhardt M. Senn, officer in charge of operations at the arsenal, Watervliet, N. Y. —*Benet Ripin*

Western Reserve Visited by President Osborn

Special guest technical speaker at the Western Reserve chapter's Sept. 27 meeting was Harry B. Osborn, Jr., national ASTE president and technical director of the Tocco Division of The Ohio Crankshaft Co. Some 65 members and guests attended the meeting at Heck's Restaurant in Columbiana, Ohio. Dr. Osborn's topic was "Tooling for Induction Heating."

—*Charles W. Ramsey*

Worcester Members Visit Rockwood Sprinkler Co.

"Tooling and Production of Fire Protection Equipment" was the subject of the Oct. 4 meeting of Worcester chapter. The program offered at plant tour at Rockwood Sprinkler Co., and a social hour, dinner and technical program at Putnam and Thurston's.

Speakers Joseph F. Pifit, Adam T. Kosciusko, Edward F. Grady and John L. Wilk covered briefly various tooling and production problems at Rockwood. Also on the agenda was the showing of a film "High Capacity Fog Foam for Fires."

Special guests attending included Karl Nowak, past chairman of Boston chapter, and Frank Clark, second vice chairman of Boston. —*Ronald H. Mead*

Springfield Chapter Host to R. J. Deneau

Springfield, Ohio, chapter gave its platform over to Robert J. Deneau, Ohio field representative of The Cross Co., for its Sept. 21 meeting at the Rustic Inn. Mr. Deneau presented a talk which was illustrated by slides on "Machine and Tool Design for Automation." He explained how his company's machinery is being used by the automotive industry. Forty-five attended the meeting. —*Kenneth W. Keller*

R. J. Guess Addresses New Jersey Members

Speaking on "Air-Operated Unit Applications," Ralph J. Guess addressed 150 members of the Northern New Jersey chapter at the Robert Treat Hotel on Oct. 11. Mr. Guess is chief tool engineer for the Vulcan Tool Co.

By special arrangement with the hotel, air-operated units were set up in the Ballroom and thoughout his talk Mr. Guess demonstrated points he wished to bring out.

Fifty students of two tool design classes at Newark College of Engineering attended the meeting in place of their regular classes. Refreshments were served by W. Herbert of Cinrock Machinery Inc. Program chairman was Robert Reade, Jr.

—*Sherwin W. Haas, Jr.*

V. J. Powers Named President, General Manager

The board of directors of Accurate Bushing Co. of Garwood, N. J., has announced the election of Vincent J. Powers as president and general manager. Mr. Powers, a member of the Philadelphia ASTE chapter, was formerly with the sales organization of Ex-Cell-O Corp. of Detroit.

Named Carbide Engineer

Firth Sterling, Inc., announced the appointment of David P. Cameron to the position of carbide service engineer in the Hartford district. Mr. Cameron, formerly with New England Carbide Co. as sales manager, is a member of the Boston ASTE chapter.

Sheridan Gets New Post

Arthur Sheridan has been named regional sales manager for Heller Brothers Co., according to an announcement by A. M. Thomas, director of sales. Mr. Sheridan is a member of the Philadelphia ASTE chapter.

HOUSTON—Pictured at the October meeting are: H. E. 'Rip' Collins, left, national vice president of ASTE; S. E. Rees, chapter secretary; and J. D. Bailleres, chapter first vice chairman.

Grant Morrison Speaks at Houston Meeting

Subject of the October technical session for Houston chapter was "The Carboloy Machinability Computer." Speaking to ASTE members and their guests was Grant Morrison, sales engineer, Carboloy Dept. of General Electric Co. Mr. Morrison described application of the computer and its uses in solving production problems electronically. —*George Bo-Linn*

Named District Manager

Thomas J. Kniff, Jr., Cleveland sales branch manager, has become central district manager for Kennametal, Inc., in Detroit. Mr. Kniff is a member of the Cleveland ASTE chapter.

Pneumatic Equipment Discussed at Erie

Pneumatic equipment was the topic of discussion at Erie chapter's October 11 meeting held at Alliance College, Cambridge, Pa. After a steak dinner served at the college, Frank Moore, field engineer for The Bellows Co., discussed air-operated devices and showed the film "Operation Push Button."

Also on the agenda was a report by Harold Hagle of the National ASTE Editorial Committee, as well as a brief talk by Thane Hawkins, of the Crawford County chapter of Professional Engineers, in which he urged professional registration. It was also announced sample questions for professional engineering examinations could be secured from Tony Jaworowicz.

—*D. J. Beecher*

Investment Casting Subject at Potomac

Describing investment casting as applied by his company, Louis E. Brooks, general manager of Jelrus Precision Casting Corp., spoke before members of the Potomac chapter on Sept. 8.

He brought along a large display of dies, patterns both metal and wax, casting trees consisting of many wax patterns mounted on wax sprues, and many samples of intricate castings to illustrate his talk. The meeting at the Hamilton Hotel was attended by 36.

—*Walter E. Larson*

LONG BEACH—This group of 110 members and guests met Oct. 5 to hear Byron R. Russell, owner of Airline Welding & Engineering Co. He presented the coffee program on a recent fishing trip as well as the technical discussion of automatic welding fixtures and procedures. The dinner meeting was held at Lakewood Country Club.

—*Jack R. Irby*

Twin Cities Chapter Tours Distant Plant

More than 90 members of Twin Cities chapter boarded a chartered bus and climbed into private cars at 6 a.m. for the 160-mile trip to Duluth, Minn. Object of the Oct. 7 trip was a plant tour of American Steel and Wire Division of U. S. Steel Co.

They saw the actual process of converting iron ore step-by-step to the finished product. Especially interesting were rolling of billets into fence posts and drawing of wire.

Past Chairman and National Director Kenneth Roby was awarded an ASTE tie clasp in appreciation of his service to the chapter by Robert M. Johnson, chairman. —*R. R. Wressell*

School President Speaks at Battle Creek Chapter

Stanley R. Cope, president of the Acme School of Die Design Engineering at South Bend, was the guest technical speaker at Battle Creek chapter's Oct. 10 meeting. More than 40 members were on hand for his presentation on "The Technical Consultant's Place in the Metal Stamping Industry" at the American Legion Clubhouse.

His talk included some of the technical difficulties of deep draw dies and was followed by a full hour question and answer period. He mentioned that 1500 things could go wrong.

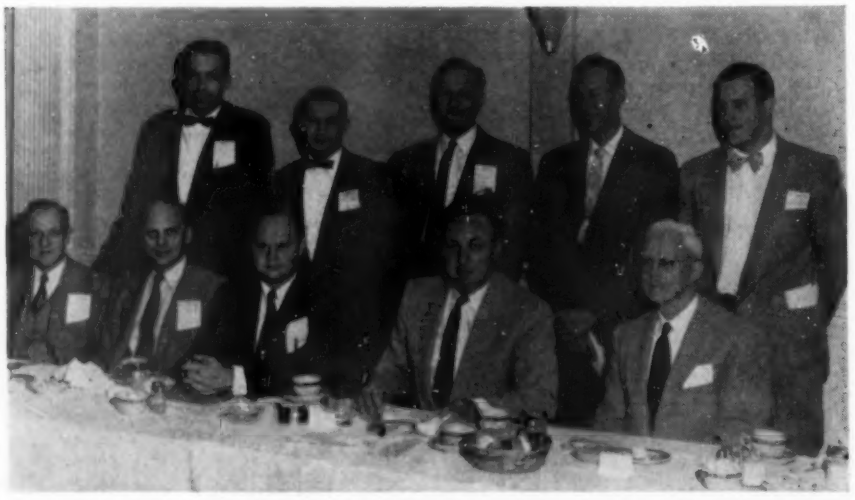
Nine new members were introduced; B. F. Kaufman received his first free dinner ticket; and B. B. Smith received a gift donated by B. F. Kaufman Co. —*Arthur F. Damon*

LOS ANGELES—Winners of the annual golf tournament, held Sept. 16 at Rancho Golf Club, were: Oliver J. Smith, left, low net winner; and Ray Mack, low gross winner. About 70 members in all participated in the program which was planned by Ralph Chrissie, Roland Hamel and O. J. Smith.

C. G. Schelly Speaks at Louis Joliet Meeting

C. G. Schelly, managing director of the Wilkie Foundation, was the main speaker at Louis Joliet chapter's Oct. 18 meeting. He had with him the now famous exhibit "Civilization through Tools," sponsored by the DoAll Co. and Wilkie Foundation.

The exhibit covers 10 panels spanning the evolution of tools from the prepaleolithic age to the present. The meeting was held at Woodruff Hotel and included steak dinner. William Neuman was technical chairman for the evening. —*Ken Hanks*



WORCESTER—The October program was presented by Rockwood Sprinkler Co. and included a plant tour and technical session. Shown here are chapter officers and company personnel. Seated: Raymond Heath, vice president; Leo P. Tarasov, first vice chairman; Joseph Pofit, chief engineer; Irving England, chairman; and Clifton P. Howard, superintendent. Standing: Alden Maynard, membership chairman; Ed Grady, metallurgist; Adam Kosciusko, chief tool engineer; Dan Hoyt, treasurer; and John Wiick, tool engineer.

Harry Conn Speaks to Pennsylvania Chapter

Harry Conn, chief engineer for Scully-Jones & Co., appeared before an audience of 60 Northwestern Pennsylvania chapter members on Oct. 6, first meeting of the season. Held at the Emporium Moose Lodge, the technical program highlighted Mr. Conn's discussion of "Tooling for Carbides." Stuffed pork chop dinner started off the proceedings. —*Frank H. Grimone*

Computer Demonstrated a Western Michigan Meeting

Detailed reports on preparatory courses for Michigan engineering registration examinations were presented by the education committee at Western Michigan chapter's meeting on Oct. 10. Three courses are slated, one provided by the University of Michigan Extension Service begun in October, and two courses offered by Michigan State University starting in January, 1956.

The technical talk at the meeting was given by Robert G. Brierley, manager of training, Carboloy Dept., General Electric Co., who spoke on "The Carboloy Machinability Computer." Through his demonstration, the computor proved to members to be an engineering tool capable of quickly providing answers to specific problems in metal-cutting. —*George A. Lensky*

Student Chapter Hears Plastics Discussion

The University of Kansas student chapter had a technical session on "What's New in Plastics?" for their Oct. 14 meeting. Philip Fleming, plastics engineer for Bendix Aviation Corp., the speaker, gave special emphasis to Iso-cynate foams.

The talk was illustrated by a demonstration of production of plastic foams, along with 150 samples of plastics and plastic parts. Free Iso-cynate sponges were distributed to those present. —*Charles Wright*

Joins Government Service

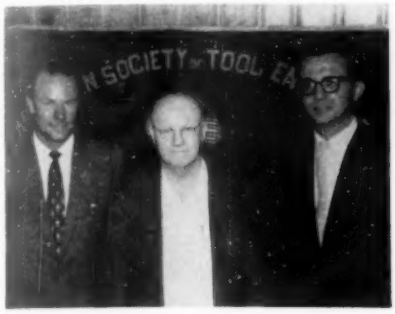
George H. Compter, assistant to the vice president and secretary of Ford Instrument Co., Division of The Sperry Corp., has been appointed consultant on synchros and servo devices to the Electrical Equipment Division, Business and Defense Services Administration, United States Department of Commerce. BSDA Administrator Charles F. Honeywell announced that Mr. Compter would serve at least six months in the voluntary capacity.

Peoria Tour Breaks Attendance Record

Setting a new chapter attendance record, 275 members and guests turned out for the October ASTE meeting. The program offered dinner at the Hotel Orlando followed by a plant tour at Marvel Schebler Products Div., Borg-Warner Corp. The major attraction was the automation program in effect for turning out 1,100 Ford transmissions every 16 hours.

Tour chairman was Russ Saurs, aided by Harold Austin, Charles Tobin, Walter Ballard and Wilbur McWilliams. —*Russ Saurs*

PEORIA—Present at the tour of Marvel-Schebler Products Div., from left, were: E. F. Bain, chapter treasurer; Walter Ballard, first vice chairman; S. Meadows, vice president and plant manager at the company; Wilbur McWilliams, chapter chairman; O. Madsen, of Marvel-Schebler; and Leo Johnson, second vice chairman.



New Orleans Chairman J. W. Page, center, is shown here with speakers Ran Hall and William Green.

New Orleans Speakers Discuss Roller Bearings

A trio of technical experts addressed members and guests of New Orleans chapter at the September meeting. They were: Ran Hall and William Green, both of Timken Roller Bearing Co., and M. P. Lammers, general manager of Dixing Bearing Co.

They spoke on the care and maintenance of the Timken tapered roller bearings in industrial plants, and the fundamental principles of the Timken bearing. Also on the program was color film on the railroad industry.

—*Joseph Natal*

Krahl Named to Sales Post

Precision Metalsmiths, Inc., announces the appointment of W. F. Krahl as sales representative for Illinois and Wisconsin. He is a member of the Cleveland ASTE chapter.

Appointments Announced

The National Automatic Tool Co., Inc., announced the appointments of Ralph Cox to Buffalo regional manager and of John Stambeck as sales engineer for the Cleveland area. Mr. Cox is a member of the Buffalo-Niagara Frontier chapter and Mr. Stambeck is a member of the Richmond chapter.

President Osborn Visits Massachusetts Chapter

In his dual role of technical speaker and national ASTE president, Harry B. Osborn, Jr., addressed members of the Southeastern Massachusetts chapter on Sept. 20.

Dr. Osborn, technical director of the Tocco Division of The Ohio Crankshaft Co., delivered his talk on "Induction Heating" before an audience of 85 members and guests in Taurnton, Mass. His talk, illustrated by slides, covered many phases of induction heating, such as heat treating, melting, soldering, welding, and preheating for forgings.

—*Karl W. Nittel*

PURDUE UNIVERSITY—ASTE was the first professional engineering society to bring an exhibit to an "Activities Carnival" staged at the Purdue Union ballrooms. Shown here is Nick Kurek explaining chapter activities to a prospective member.

"Atomic Age and You" Is Pittsburgh Topic

Unlimited opportunities available to the tool engineer in the atomic age were outlined Oct. 7 at a meeting of 120 Pittsburgh members and guests. Speaking to the group was Frank B. Rackley, president, Jessop Steel Corp., and one of the nation's youngest steel company executives. He warned that the tool engineer who does not gear himself to the rapid advancement being made in the atomic age will fall by the wayside. The discussion following Mr. Rackley's address indicated keen interest by Pittsburgh tool engineers on the subject of atomic power and its application in industry.

—*E. L. Caughey*

Dr. Stewart G. Fletcher Presents Toledo Program

Meeting at the Maumee River Yacht Club on Oct. 12, about 65 Toledo members heard a talk on modern developments in tool and die steels. Program speaker was Dr. Stewart G. Fletcher, chief metallurgist, Latrobe Steel Co.

He illustrated his talk on high vanadium, free machining, and precipitation tool steels with slides. Dr. Fletcher also discussed the improved steel compositions and quality control of tool and die steels. After the talk, a film entitled "The Heart of the Matter" was shown to the audience.

—*Harold H. Krueger*

coming ASTE meetings

National

NATIONAL PROFESSIONAL ENGINEERING COMMITTEE—Dec. 3. National Headquarters, Detroit.

NATIONAL PROGRESS COMMITTEE—Dec. 9. National Headquarters, Detroit.

NATIONAL HONOR AWARDS COMMITTEE—Dec. 10. National Headquarters, Detroit.

NATIONAL STANDARDS COMMITTEE—Carbide Subcommittee, Dec. 12, 13. National Headquarters, Detroit.

Chapter

BENTON HARBOR-ST. JOSEPH—Dec. 8. Schuler's Restaurant. "Oil Hydraulics on the Production Line."

BOSTON—Dec. 8. "Pre-alloyed Steel Powders and the Designer" and "Fabrication of Powder Metal Parts" by W. L. Batten, manager metallurgy department, Vanadium-Alloys Steel Co.; and Norbert A. Arnold, development engineer, Deyssone Carbon Co., respectively.

COLUMBUS—Dec. 14. Beechwold Inn. Annual Christmas party.

DETROIT—Dec. 8. Christmas party.

FOND DU LAC—Dec. 9, 6:30 p.m., Oshkosh. Contact Martin E. Kozak of Oshkosh for reservations.

GRANITE STATE—Dec. 13, 8 p.m., Rochester, N. H. "Ultrasonic Impact Grinding" by Ralph Maschella of Raytheon Co.

GREATER NEW YORK—Dec. 5, 6:30 p.m., New York Times Building, 229 W. 43rd St. Ladies Night. "Gadgets" by Don Davis, Gadgets, Inc.

HAMILTON DISTRICT—Dec. 9. "Canada's Position in International Trade" by Stewart B. Armour of Stelco.

HENDRICK HUDSON—Dec. 14, 6:30 p.m., Circle Inn, Latham, N. Y. "The Grinding Wheel as a Cutting Tool" by Dr. Leo P. Tarasov, head of research and development, Norton Co.

LEHIGH VALLEY—Dec. 9, 7 p.m., Carney and Stansfield Co., 270 E. Hamilton St., Allentown, Pa. Participate in plant tour and machine tool show.

LONG BEACH—Dec. 3, 7:30 p.m., Lakewood Country Club. Annual ladies night and dinner-dance.

LOS ANGELES—Dec. 16, 8 p.m., Del Mar Club, Santa Monica, Calif. Annual Christmas dinner-dance.

LOUIS JOLIET—Dec. 3, Joliet Elks Club. Ladies night.

LOUISVILLE—Dec. 9, 6 p.m., Wildwood Country Club. Ladies night.

MID-HUDSON—Dec. 13. "High Efficiency Machining Coupled with Machinability Computor" by T. Hayes, G. E. Carboloy service engineer. Film "Keys to Quality" on automation by I.B.M.

MILWAUKEE—Dec. 8, 6:30 p.m., American Serb Memorial Hall. "Extrusions and Extrusion Presses" by H. C. Sproule, district sales engineer, Loewy Hypro Press, Inc.

MONADNOCK—Dec. 15, 8:30 p.m., St. George's Hall, Keene, N. H. Ladies night—dancing and Monte Carlo games.

ASTE Industrial Exposition and 24th Annual Meeting will be held March 19 through 23, 1956, at Chicago, Ill. The Exposition will be held at the International Amphitheatre.

NEBRASKA—Dec. 15, Lincoln, Neb. "Plastic Tooling" by representatives of Renite Plastics, Inc.

NIAGARA DISTRICT—Dec. 1, Rose Villa Inn, Welland, Ont. "Production Tooling Problems" by Harry Conn, chief engineer for Scully-Jones & Co.

NORTHERN NEW JERSEY—Dec. 13. "Machine Tool and Vibration" by a representative of Consolidated Engineering Corp.

PIEDMONT—Dec. 12, Hotel Charlotte, Charlotte, N. C. "Civilization through Tools" by C. G. Schelly of the Wilkie Foundation. Joint meeting with ASME.

PITTSBURGH—Dec. 16, 6:30 p.m., Gateway Plaza. Christmas party.

SOUTHEASTERN MASSACHUSETTS—Dec. 13, Cotillion Room, Taunton, Mass. "Automation" by Robert Me[illegible]am and William Munro of Metals and Controls Corp.

TWIN CITIES—Dec. 7, 6:30 p.m., Covered Wagon Cafe. "Tooling of Multiple Spindle Automatics" by R. R. Rhodehamel, general sales manager, National Acme Co. Also winners of three $100 scholarships, offered by chapter, will be presented to the membership.

TWIN STATES—Dec. 14, Springfield, Vt. "Machine Tool and Vibration" by a representative of Consolidated Engineering Corp.

WINDSOR—Dec. 12, 6:45 p.m., Prince Edward Hotel, Windsor. "Metal Flow in Deep Drawing Operations on Aluminum" by John W. Lengbridge, project engineer, Aluminum Goods, Ltd.

WORCESTER—Dec. 6, 6 p.m., Holden Country Club. Christmas party.

Niagara Members Learn About Titanium

More than 70 members of Niagara District chapter were present for the October dinner meeting held at Rose Villa Inn in Welland. Technical speaker at the session was H. V. Kinsey, of the Department of Mines and Technical Surveys, Physical Metallurgy Div.

His topic was "Titanium" and during his discussion, he compared current production figures with those of 1947, when only 200 pounds of the material were produced in the United States. Last year production reached 7,200 tons and the target for '55 is 14,000 tons.

Coffee speaker was J. R. Gregory, division manager of Aircraft Ordnance, Thompson Products Ltd., who stressed the importance of leadership in developing Canada to its fullest.

—William A. Yaeger, E. A. Lindvall

"Hydrospinning" Topic of San Fernando Discussion

Featured speaker at the Oct. 5 session was C. R. Heimlich of the Process Machinery Div., Cincinnati Milling & Grinding Machines, Inc. He showed slides and thoroughly discussed the metalworking process "Hydrospinning."

Another highlight of the evening was the rush to purchase the new *Die Design Handbook* from Treasurer Roy Goodspeed who had ordered a quantity shipped in advance to the chapter.

—Sam Schwartz

...terpillar Tractor Co. ...oured by Tri-Cities

...acilities at the Peoria plant of Cat...pillar Tractor Co. were visited Oct. ... by Tri-Cities chapter. About 70 ...mbers took part in the tour, which ...luded heat treating, receiving and ...specting of materials, metallurgical ...boratory and tractor shipping. Dinner ...rved in a plant cafeteria concluded ...e day's activities.

In September the members heard a talk on "Flexibility of Hydraulic Presses, Brakes and Shears." George E. Abbe of Pacific Industrial Mfg. was the speaker. —*Don Shewry*

Golden Gate Hears Patent Attorney

Meeting at Spenger's Restaurant in Berkeley, some 130 Golden Gate members were on hand for the September technical session. The program was presented by Charles O. Bruce, registered patent attorney with the firm of Bruce & Bosler.

Mr. Bruce spoke on the subject "Goofy Gadgets" which covered an interesting array of oddities in the field of patents. He made use of illustrated slides which portrayed some patents on peculiar inventions. —*John E. Wilson*

Don Guy Addresses Grand River Chapter

A group of 60 members and guests of the Grand River chapter was on hand to attend a recent program put on by Don Guy, engineer for the Bellows Co. Introduced by Arthur Godden, Mr. Guy spoke on applications of Bellows equipment and show a film illustrating the uses. A demonstration with practical setups in actual operation was also included.

A question and answer concluded the technical session, which was followed by a social hour. —*W. C. Little*

San Antonio Members Hear Grant Morrison

Sales engineer for the Carboloy Dept. of General Electric Co., Grant Morrison was the guest technical speaker at San Antonio chapter's Oct. 12 meeting. He chose as his subject the Carboloy machinability computer, its application and uses. With the aid of color slides, Mr. Morrison discussed features, cutting angles and other illustrations of interest. Forty-eight attended the meeting at the Gunter Hotel. —*Stanley G. Gower*

Plant Visit Made By Granite State

A tour of facilities at the Hytron Plant of Columbia Broadcasting Co. was made Sept. 27 by Granite State chapter. About 50 members witness procedures used in the manufacture of radio tubes and later heard a discussion on industrial problems by J. C. Harmony, plant manager.

A number of guests from Boston chapter were present for the meeting held at Danvers, Mass. —*Kenneth R. Stone*

Seattle Breaks Attendance Record

A record-breaking attendance of 115 members and guests was present for Seattle's opening meeting of the season. Featured speaker was E. D. Pettler, field engineer with Consolidated Engineering Corp. He spoke on "Machine Tools and Vibration."

Another part of the program was devoted to the showing of a film which won the industrial 'Oscarette' for 1955 and which drew high praise from the Seattle audience. —*Harold F. Hanson*

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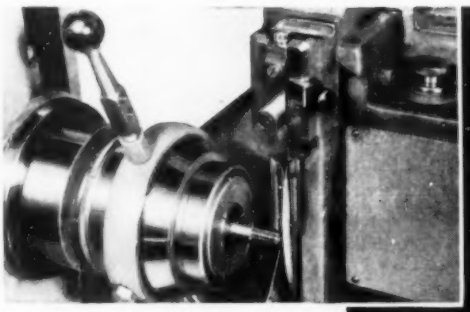

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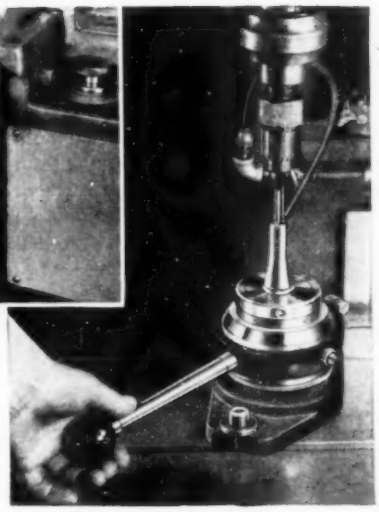

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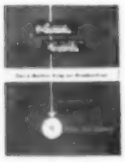

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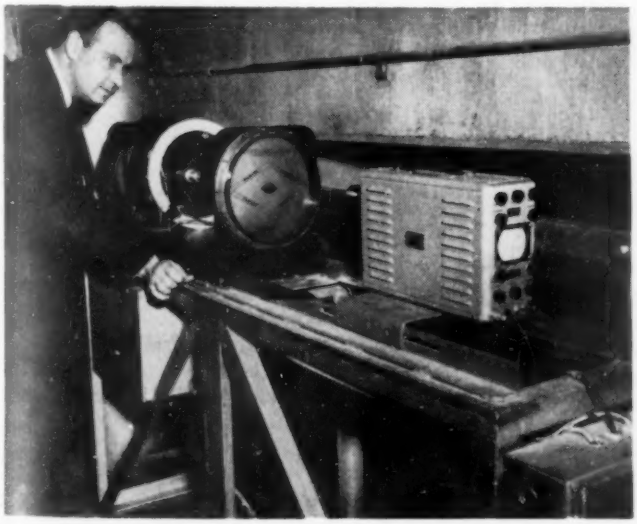
This use of TV on an industrial plane has been instituted in the U. S. Air Force Heavy Press Plant at Aluminum Co. of America's Cleveland works. The 35,000-ton press and a 50,000-ton press forge aircraft structural components. During operation, the complicated shape of the forging may cause eccentric loading of the platens. A limited amount of eccentricity is allowable and compensated for. Stretching of the tie rods, which hold the press within safe operating limits, measures the degree of deflection. Such distortion is reflected in four hydraulic cylinders at each corner of the press. Engineers of United Engineering and Foundry Co., builders of the press, attached small hydraulic lines to each cylinder and these lines are connected to the mechanism viewed by the TV camera, which in turn duplicates in miniature the observed differences.

When the press is centrally loaded, a beam of light is focused in the center of a diamond-shaped gage viewed by the camera. Off-center loading causes the beam to move toward the border of the diamond, thus indicating

A television camera, located in the press foundation, is focused on the diamond gage. A picture of the gage is shown on the receiver at the operator's control station.



Located in the portable control station of the 35,000-ton press, the TV receiver keeps the operator instantly informed of the proper or improper loading of a die in the press.

the location of load center. The press operator notes the movement on the receiver and can prevent damage to the machine by corrective action. Should the operator fail to act quickly enough, the light touching the boundary of the diamond shape automatically causes all movement to stop.

Designers anticipate the innovation will help improve forging die design. Causes of eccentric loading may now be charted and defective design can thus be avoided in future tools.

QUALITY CONTROL PROGRAM PERMITS CERTIFIED METALS

Fabricators will be able to save time while reducing production costs because of the "quality certification" achieved by Mallory-Sharon Titanium Corp. By usining statistical quality control techniques to improve the uniformity of its unalloyed titanium sheet, the company now is able to certify mechanical properties within narrow ranges.

With this certification each heat of material is accompanied by a test report assuring uniform average strength level and stating the narrow limits of variability. These certified properties are based on a statistical confidence level of 97.5 percent.

Hardness testing of production sheet material is part of the program.

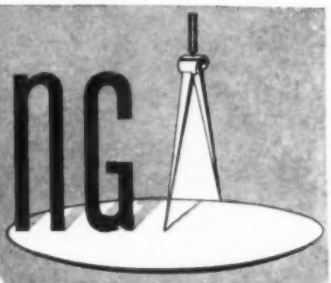
Previously, variations in mechanical properties created a number of problems. Purchasers of titanium mill products called for strength in a specified range, but variations in strength within this range were unpredictable. Consequently, fabricators were forced to check and segregate all incoming unalloyed titanium sheet into different yield strength levels. The wide variability in strength necessitated different dies and tooling setups, creating a costly operation.

According to Mallory-Sharon officials, major improvements in production techniques as well as statistical quality control made certification possible. Raw sponge is checked for hardness and purity and sample ingots are melted and rolled to sheet for complete physical and chemical tests. Similar tests and inspection are applied throughout all stages of production. The accumulation of tests and data on materials in process provides the sources of authoritative measurement of specific properties.

SPECIAL TOOLING SOLVES MACHINING POSER

Special machine design has again produced the solution to a tough production problem. A current project at Radio Corp. of America is special deflecting yokes for use in color receivers. Four coils with a core molded in 4 segments to provide essential electrical characteristics, make up the deflecting yoke. The segments are molded from a special ferrite mix process similar to powder metal proc-

to economize
STANDARDIZE *with* RING



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Ring Standardized Punches and Dies offer cost saving dependable performance for all of your perforating problems.

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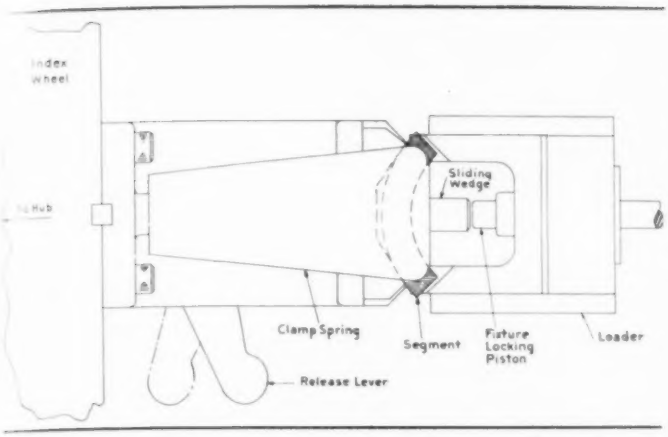

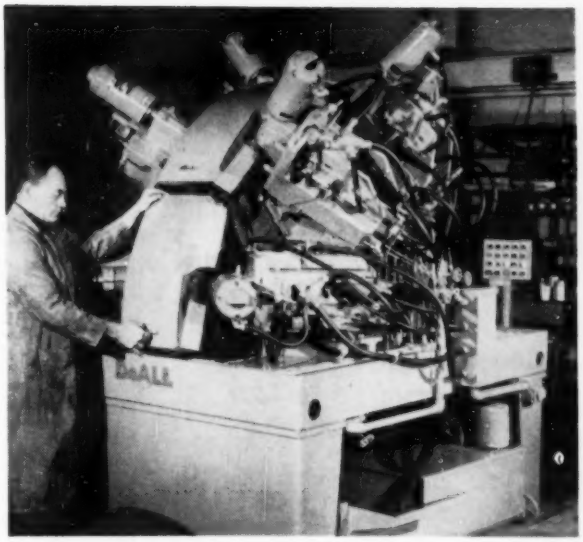

Above. **Drawing shows top view of the fixture, indicating position of the loaded segment. Lever extending below is tripped by a hydraulic piston at the end of a cycle to release a finished part.** *Right.* **Side view of unit shows twin-spindle, 3-station design.**

essing. After molding, parts are sintered and become hard enough to cut glass.

The problem involved forming eight mating surfaces between 4 segments with a precise accuracy in order to produce an exact cylinder. The equipment developed by DoAll Co. was a precision automatic surface grinder which produced a smooth surface and true 90-deg angle on each mating end.

To achieve this result, the unit is designed to automatically load the part, align, grind and discharge it. Both ends of the segment are ground, simultaneously, down to the desired dimension, finish and flatness in three fast, successive grinds. Planes of the ground ends are maintained at 90 deg to each other within 50 microinches over the $\frac{7}{8}$-in. end width. This accuracy is held while the unit is producing pieces at a speed of one piece every three seconds.

Segments to be ground are stacked in a vertical hopper, ends facing out from the machine. A hydraulic loader at the base of the hopper pushes the bottom-most segment into one of 36 fixtures mounted on the periphery of a large motorized index wheel. Upon seating the segment, the loader also pushes a lever that causes the fixture to clamp the segment in place. The wheel then indexes 10 deg, moving the loaded fixture toward the first pair of grinding spindles and the next fixture up to the loader. At each of three grinding stations through which workpieces are carried, the index wheel stops and is locked in accurate position for work. Twin grinding spindles, moving hydraulically on hand-scraped ways, carry diamond, cup grinding wheels across the segment faces. At the first station, all but 0.035 in. is removed; at the second, 0.025 in. more and at the third station the final 0.010 in. of stock is ground off, bringing the piece to size and generating a surface flat and square to 20 millionths.

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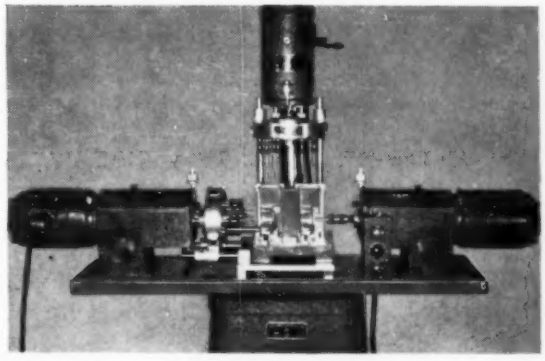
ALL-ELECTRIC operation and control... for the fastest, most accurate tapping yet!

No reversing motor needed — electro-magnetic clutches do the work

This exclusive feature provides a speed, sensitivity and precision unequalled by any other tapping method or device. It eliminates the need for a reversing motor, cams, air and hydraulic systems. You get these advantages in both single and multiple spindle operation because Ettco-Emrick Lead Screw Tapping Equipment can be used as single spindle units or with Ettco-Emrick Multiple Spindle Heads. The equipment is furnished: (1) as individual units; (2) as standard upright machines; or (3) as special machines built either by us or by you to your requirements.



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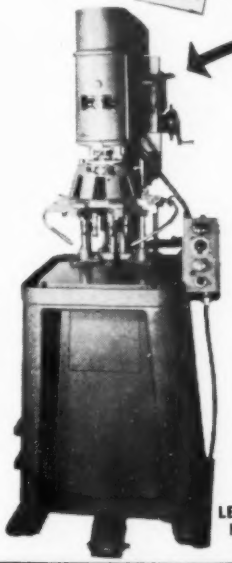
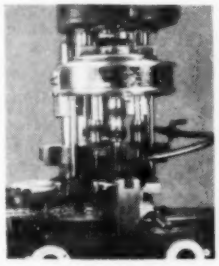
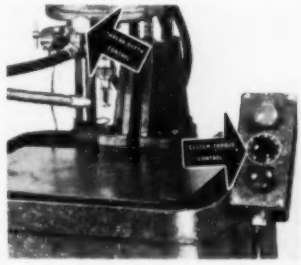
LEAD SCREW UNIT

BASIC LEAD SCREW UNITS when combined with standard Lead Screw Machines and Ettco-Emrick Multiple Heads and workholding fixtures give the advantages of high speed, precision "specials." Standardized Ettco components make this tooling practical and inexpensive.



LEAD SCREW MACHINE





MULTIPLE HEADS and workholders are "Unit-Engineered" to insure fastest loading, positioning, tapping and ejection.

Clutch torque can be regulated to meet tapping conditions. Thread depth can be controlled to within ¼ turn of tap.

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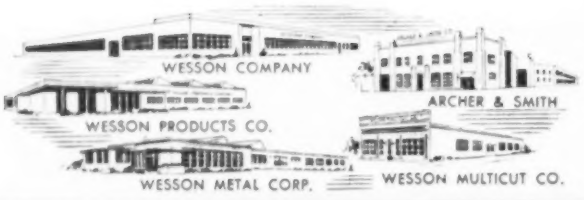
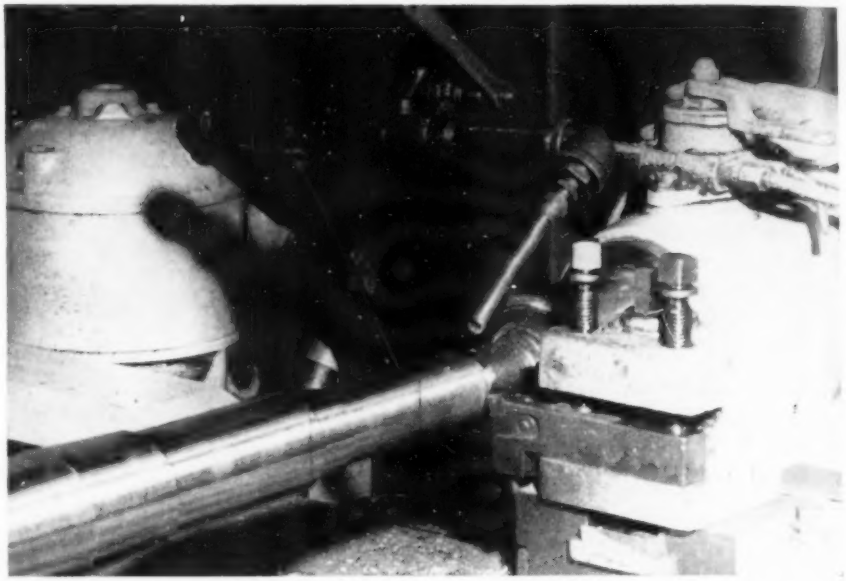


carbide NEWS

26 Outperforms Other Carbides 8:1

Boosts sprocket shaft output from 15 to 120 pieces per grind



In a series of production comparison tests, Grade 26 again came out on top—this time in machining forged steel (Rockwell 44) tractor sprocket shafts at a large midwestern tractor company.

With Wessonmetal 26, output averaged 120 pieces per grind as compared with 15 pieces per grind for all other steel cutting grades tested.

The operation is performed on a new 20" Monarch Air Gage Tracer lathe and consists of finish turning the shaft diameter, forming radii and chamfers, and rough turning all other diameters. Length of travel in the cut is 18¼"; speed 375 sfpm; feed range from .009 to .012". Average depth of cut for all diameters is ¼-inch.

Primary reason for the big increase in life achieved with Wessonmetal 26 is its ability to stand up under widely varying conditions. Inserts made of other carbides shattered or broke after 12 to 15 pieces on one cutting edge and could not be indexed. This trouble was eliminated with Grade 26, which averaged 20 pieces per edge and could be indexed to give a total of 120 pieces per grind.

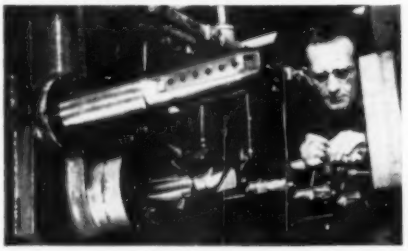
Worthy of note also is that the performance of Wessonmetal 26 (a "nearly universal" steel cutting grade) was achieved in comparison even with carbides of a specialized nature specifically selected for this operation.

New Film Points Way To Better Tooling

One of the most dramatic technical sound films yet produced is now released by the Wesson Company for showings to technical and shop groups.

Built around the development of tooling for an actual job—the machining of tractor track links—the 16 mm. technicolor sound film—which took two years to complete—records the *failures* as well as the successes achieved. The trials and tribulations encountered will remind many of their own experiences.

Entitled "Tools of Abundance," the film tells how a large manufacturing committee working with Wesson tool engineers carried a specific job through to completion. It is the story of how cooperation helps to develop and improve American manufacturing methods.



This story of teamwork—supplemented by about a dozen other general machining and high production operations in the film—provides a rational approach to solving other difficult tooling problems. For a showing to YOUR company, write for the film on your company letterhead. A Wesson man will bring it to you.

tools Wesson carbide Wessonmetal

WESSON COMPANY
DEPT. AD
1220 Woodward Heights Blvd.
Detroit 20, Michigan

Tool Hints

If you have an idea that you would like to get better tool life on a job than you are getting, do these things and you may find you were right:

1. Check for vibration and chatter and eliminate all you can. Both are deadly to tool life.

2. Check whether the rake angles are correctly ground. There is a best combination for any job.

3. Check whether you have the ideal combination of speed and feed.

4. Check whether tools are changed before they get too dull. Dull tools wear faster than sharp ones. Keeping them at work is false economy.

5. Check tool after each sharpening against the tool PRINT. This is excellent insurance.

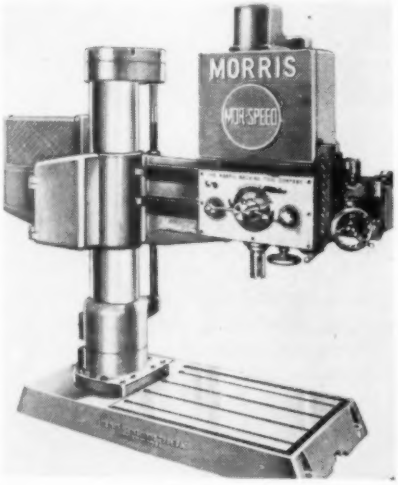
None of these suggestions are new. But they are still keys to better tool performance.

(P.S.—A sixth method is to call in a Wesson man)

TOOLS of today

Radial Drill

Radial drill operation is easier and faster because of push buttons used to replace conventional levers and handwheels in a new line of 13 and 15-in. column radial drills. Pushing a button raises or lowers the arm; traverses the head left or right; clamps or unclamps



the arm, head or column, and will also shift the gears.

Equipment in this Hydra-Power line is hydraulically actuated. All push buttons are located in a single panel, positioned for easy reach of the operator.

A single, integrated electrohydraulic control system simplifies supervision of the operation of all components.

A prime feature of the unit is its preselective spindle speeds and feeds, making it possible to select the spindle speed and feed for the next operation while the current operation is being performed. When the current operation is complete, the operator pushes a button and the new speed-feed combination is automatically selected by the hydraulic device.

The large diameter quill is mounted on precision bearings as close to the work as possible. The bearings remain at the same distance from the work point as the tool is fed. The spindle is equipped with an adjustable counterbalance to offset excessive weight of special tools and adaptors.

Other features of the Hydra-Power radial drills include: an automatic tool ejector for quick, easy tool changes; 36 spindle speeds in either of 4 ranges; and 18 feeds including 8, 11½, 14, 18 and 27-thread leads.

To assure safety, the drill arm cannot be raised or lowered while clamped. Safety stops prevent overtravel of the arm in raising and lowering, and overtravel of the head in traversing. To prevent gear changing while the spindle is rotating at high speeds, a special hydraulic interlock is provided.

Morris Machine Tool Co., 933-37 Harriet St., Cincinnati 3, Ohio.

T-12-1551

Hack Saw Blade

A single double-edge blade has been developed to handle all thicknesses of metal-cutting. Eighteen teeth on one edge are designed for general heavy cutting such as on bolts, pipe and rod; 24 teeth on the other edge are for cutting thin sections such as sheet metal, light tubing, thin wall conduit, etc.

G. W. Griffin Co., Franklin, N. H.

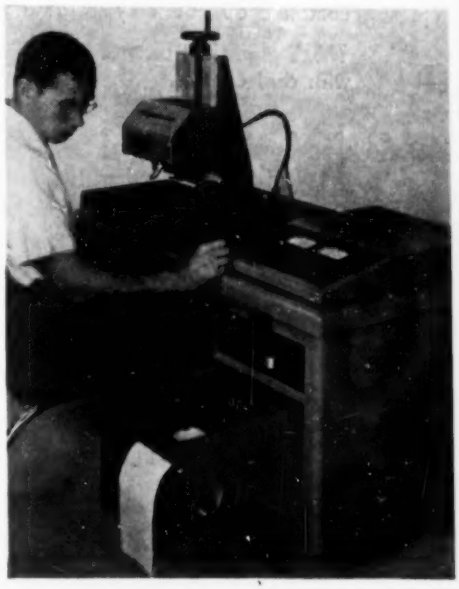
T-12-1552

Profile Recording Device

Profile of internal and external machined and finished surfaces is recorded on a permanent magnified chart by means of a mechanical-electronic instrument called the Proficorder.

This instrument records (1) waviness, bows, steps and other widely spaced irregularities, with surface roughness omitted; (2) roughness irregularities alone, with waviness omitted; or (3) the combined roughness and waviness profile. Selection of which record is made is by push buttons on the instrument's control panel. Besides the information outlined, a meter on the control panel also shows the average height of the roughness profile being recorded.

This Proficorder includes a tracer, a pilotor, and an amplicorder. All working parts are mounted on or in a desk



type console. The piece being profiled is placed on the Pilotor base plate, and the piloting mechanism moves the tracer in a plane parallel to the work surface a 0.005 in. per second, over any desired length of trace from 1/16 to 11/2 in.

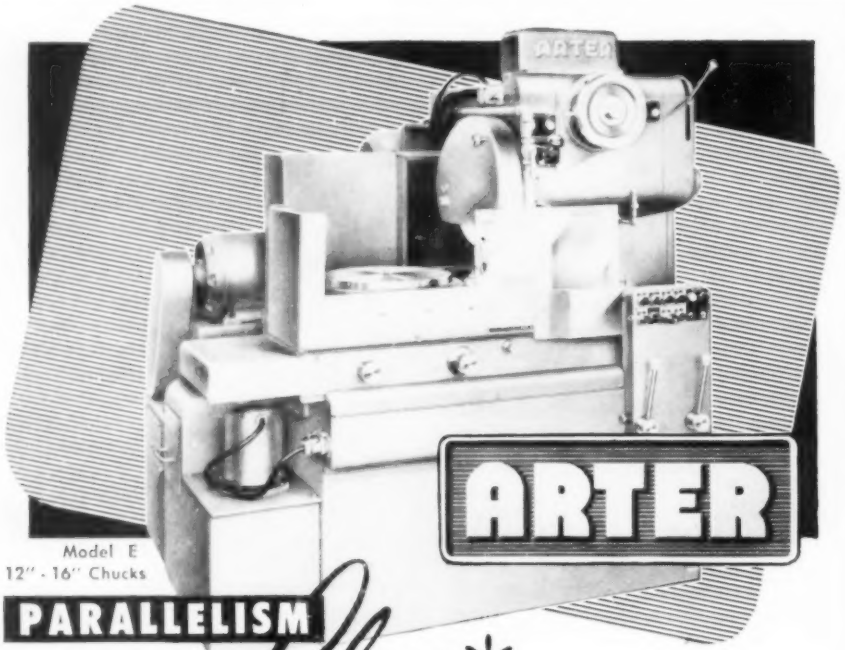
The Tracer, a differential-transformer type transducer, has a stylus with a diamond tip of 0.0005 or 0.0001-in. radius which moves along the surface; and the output voltage of the tracer is modulated in accordance with the vertical position of the stylus. Six vertical magnifications are provided from 0.000025 to 0.0005 in. per chart paper division and are selected by push buttons on the control panel.

A gear shift lever on the recorder chart drive provides 7 horizontal magnifications, from 0.001 to 0.100 inch per chart paper division.

Micrometrical Development Corp., 2821 S. State St., Ann Arbor, Mich.

T-12-1561

USE READER SERVICE CARD ON PAGE 171 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION



Model E
12" - 16" Chucks

PARALLELISM *Plus**

* **MANUAL and AUTOMATIC** controlled hydraulic operation to work table. Can be arranged for complete automatic cycle grind.
* **TABLE MOUNTED Diamond Dresser** with dial control.
* **STEPLESS VARIABLE SPEEDS** to table and chuck rotation. Tiltable chuck.
* **HAND and AUTOMATIC WHEEL FEED** with power retraction.

Model E Hydraulic Rotary Surface Grinder (12 and 16" Chucks) has taken an honored place in the Arter Family of Machines after attaining a record of performance to which we point with pride.

ARTER GRINDING MACHINE COMPANY

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Jigmatic Automatic Tape Controlled Positioning Table • Rotary Surface Grinders
Flat Circular Cutter Grinders • Internal Grinders • Cylindrical Grinders • Carbide Tool Grinders

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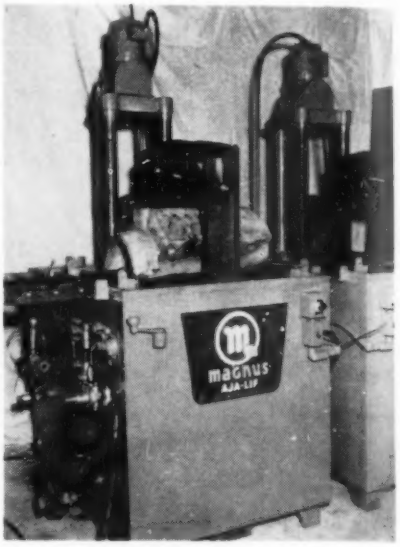
Cleaning Machine

A work-carrying platform combining rotary motion with vertical up-and-down agitation is the prime feature designed into the recently developed Magnus Aja-Lif cleaning machine with "gyro-vertical motion." Work is moved up and down 120 times per minute; at the same time it is slowly rotated. Oils, loose chips, casting sand and similar industrial soils are quickly and easily removed from intricate castings.

After completion of the washing cycle, the platform is raised to unloading position. The rotation of the work continues for a few seconds to completely drain all liquids from inside



recesses of the part being cleaned. A hold-down device is released and the operator transfers the work to the rinse machine where the process is repeated.

The cleaning unit requires no special foundation and can be installed in any existing production line.

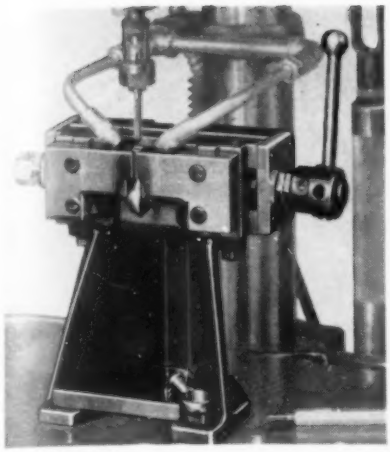
Magnus Chemical Co., Inc., Dept. TE, Equipment Div., Garwood, N. J.

T-12-1562

Work-Holding Jig

An automatically self-centering work-holding device, the John's Drill jig, has two moving master jaws that work on a right and left-hand Acme thread, that allows them to come to the same distance from center every time. The self-centering action will hold within 0.0015 inch or better.

It gives precise, instant centering, rigid clamping of work, fast chucking, visibility and adequate chip room. It is economical whether used on short or long runs. The self-centering feature offers an extra advantage when the



device is used as a milling vise.

The John's jig is particularly suitable for precision cross or end drilling of round, hexagon, or square stock, and standard or odd-shaped smooth or rough castings, from 1/8 to 8 in. OD.

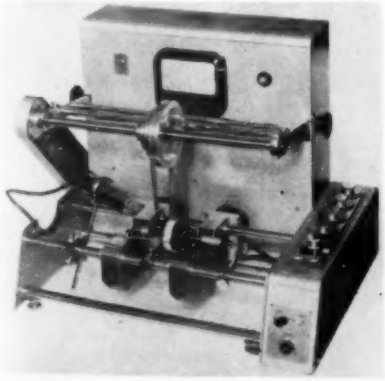
Standard removable slip fit bushings and holders are available to drill center or mean-off-center holes from #60 to 11/32-in. drills. Special bushing holders for multidrill operations are easily tooled.

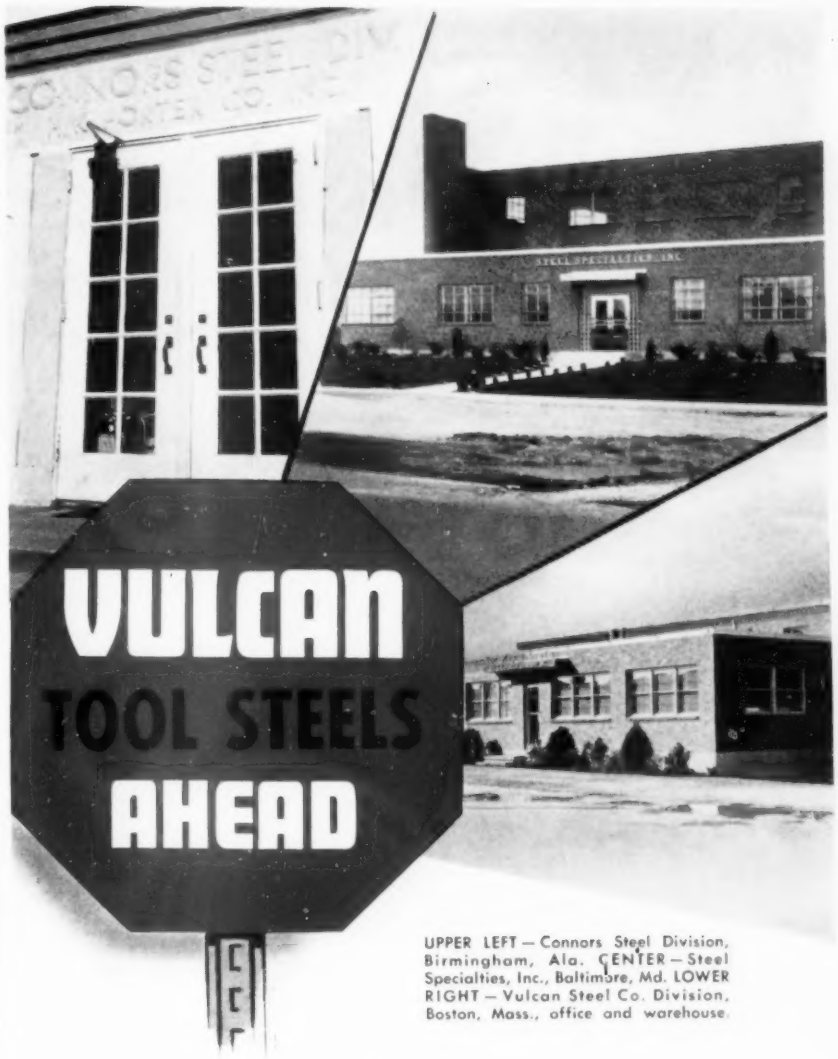
The tool is available in three sizes, 6, 8 and 14 in., and in jaw openings of 2, 41/4 and 71/4 in. Bases are available for mounting the jig from 1 to 18 in. off the working surface. The handle is reversible.

Heuser Mfg. Co., 1638 N. Paulina St., Chicago 22, Ill. **T-12-1571**

Dynamic Balancer

Quick and accurate location of the out-of-balance in two planes of correction, as well as information on the amount of correction necessary, is supplied by a recently developed electronic balancing machine. Correction measurements are indicated on a meter and angular location of the out-of-balance pointed out by means of stroboscopic lamp. The machine may be used by an





UPPER LEFT — Connors Steel Division, Birmingham, Ala. CENTER — Steel Specialties, Inc., Baltimore, Md. LOWER RIGHT — Vulcan Steel Co. Division, Boston, Mass., office and warehouse.

improving service to you

Additional sales and distribution outlets—in key areas—mean VULCAN Tool Steels are *directly* ahead of you.

The big advantage is that you will find it easier to obtain the exceptionally high quality tool steels produced by VULCAN. VULCAN's emphasis on *forging* adds assurance of high quality.

Your end result is the finest tools and dies you can make.

VULCAN Tool Steels are available in all types, shapes and sizes. See your nearby VULCAN representative, or write for VULCAN Tool Steel Data bulletin, with your representative's location.

Vulcan Crucible Steel Co. Division

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FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-12-157

unskilled operator after only brief instruction and balancing of components often is accomplished within 30 seconds.

This unit, the Type 1250, measures out-of-balance masses as low as 0.0013 percent of total weight.

Control switches select either right or left-hand plane for correction and readings of each plane are independent of the amount of unbalance in the other

Parts or assemblies up to 13 in. long, 5 in. wide and 10 lb. in weight can be handled. All controls are preset except those necessary for operators' use.

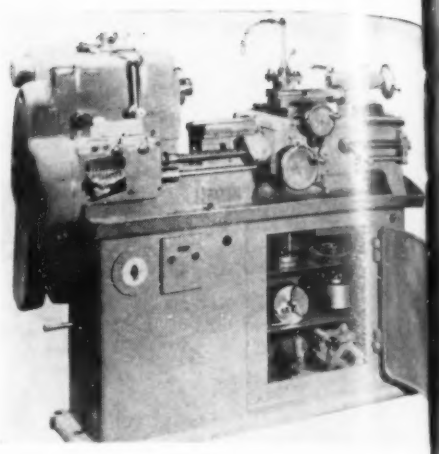
The Hickok Electrical Instrument Co., 10649 Dupont Ave., Cleveland 8, Ohio. **T-12-1581**

Lathe

The Harrison 11-inch swing, 24 or 40-in., quick-change, geared-head lathe, which offers an 18-in. swing in gap and a 4½-in. width in front of faceplate, is designed for sturdiness plus high precision. Equally adaptable for toolroom or production work, this small, versatile, low-cost lathe offers eight spindle speeds of 42-960 rpm. Alternative range is available with a two-speed motor, allowing 16 spindle speeds of 31 to 1440 rpm.

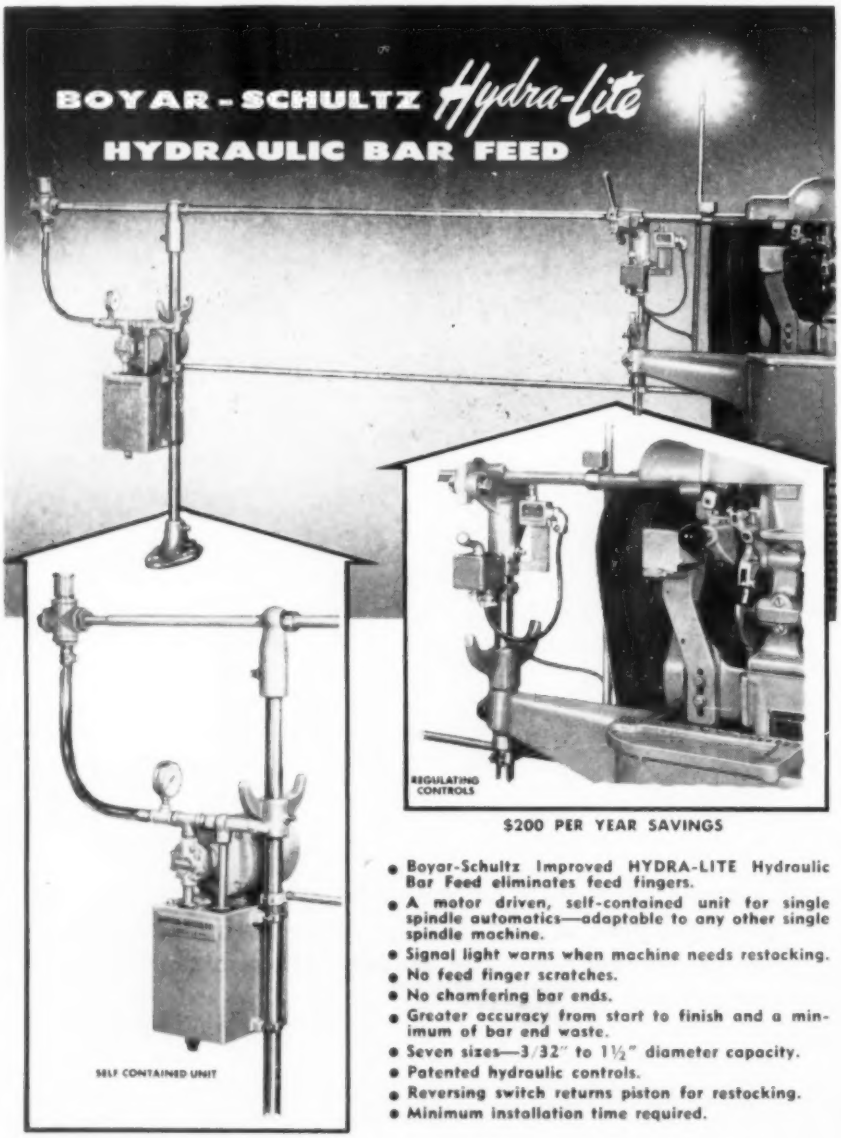
The carbon steel spindle, with long taper key drive nose L00, is splined and bored to pass 1¼-in. bar.

The bed is of half-box form with uniform thickness throughout, and is well ribbed and cross-braced to prevent deflection or twist under the heaviest cutting load within the capacity of the machine.



Dimensions of the lathe are: bed length of 51 or 67 in.; bed depth, 7½ in.; 24 or 40 in. between centers; 6½-in. bed-width over shears; 8⅛-in. swing over saddle; 7-in. max cross slide feed; 2⅞-in. max top slide feed; 4-in. movement of loosehead spindle; 8 or 16 spindle speeds; 1¼-in. diam spindle bored to pass; 1⅛-in. diam leading screw with 4 tpi; range of threads is 4 to 60 with 36 speed gearbox.

Distributorships for the unit are now being assigned in the United States by Stanley Sheppard, 30 Church St., New York 7, N. Y. **T-12-1582**



$200 PER YEAR SAVINGS

- Boyar-Schultz Improved HYDRA-LITE Hydraulic Bar Feed eliminates feed fingers.
- A motor driven, self-contained unit for single spindle automatics—adaptable to any other single spindle machine.
- Signal light warns when machine needs restocking.
- No feed finger scratches.
- No chamfering bar ends.
- Greater accuracy from start to finish and a minimum of bar end waste.
- Seven sizes—3/32" to 1½" diameter capacity.
- Patented hydraulic controls.
- Reversing switch returns piston for restocking.
- Minimum installation time required.

BOYAR-SCHULTZ CORPORATION Dept. D-S, 2004 SOUTH 25TH AVENUE

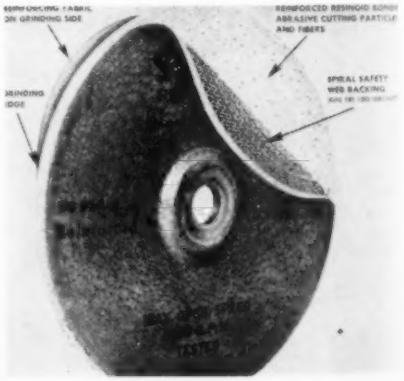
BROADVIEW, ILLINOIS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-12-158

Abrasive Wheels For Portable Grinders

Extra strength and safety are designed into the high-speed abrasive Simex Red wheels because of a special safety web backing of spiral wound rayon auto tire cord.

These lightweight, rigid type reinforced resinoid bonded abrasive wheels may be used on portable disk type and right-angle type grinders. Made in depressed center or raised hub shape in 7



9-in. diameters by 3/16 and 1/4-in. thicknesses, they are useful for particularly rough production grinding such as grinding welds, removing flash and burrs, cleaning up rough ragged surfaces and edges, and for all types of stainless steel. Their fast abrasive cutting action permits heavy stock removal while durable construction provides unusually long wheel life. The wheel itself is made like a conventional grinding wheel from a mix consisting of abrasive cutting particles and synthetic resin bonding agents, reinforced with alpha cellulose fibers crisscrossed and knitted together throughout the wheel mass. In addition to the extra safety web backing on the top side, the under, or grinding side has a layer of reinforcing fabric for added strength in all directions of force applied on the wheel. There is a knurled or filetype pattern on the grinding or cutting side of the wheels to increase their cutting action.

For weld grinding work, the leading edge of the wheel is used at about a 30-deg angle with the work so that actually it cuts away the excess metal instead of grinding it down. Finishing or cleaning up is then done with the grinding side at about a 15-deg angle with the work.

Simonds Abrasive Co., Tacony and Fraley Sts., Philadelphia 37, Pa. **T-12-1591**

USE READER SERVICE CARD ON PAGE 171 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Hydraulic Control Device

A back pressure control system for hydraulic circuits combines the functions of pressure sensing element, control pilot and control valve in a single unit.

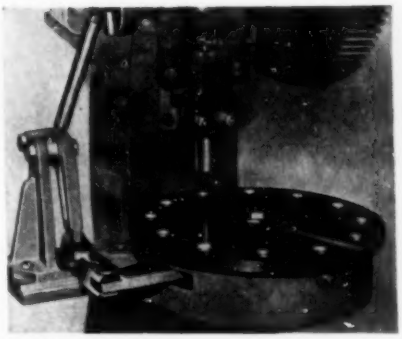
This device, called the Micro Delta P controller, provides square-wave pressure response, microsecond control without hunting and constant pressure throughout full flow range.

Industrial Engineering Corp., 525 E. Woodbine, Louisville, Ky. **T-12-1592**

Dial Index Feed

An automatic dial index feed for use on Benchmaster and other types of punch presses and on drill presses, converts a standard machine to almost full automatic operation. With special one-purpose tools, it operates at rates up to 6,000 strokes per hour. Installation of the unit to the machine is fast and simple.

The rotating table is actuated with each stroke of the punch press ram or



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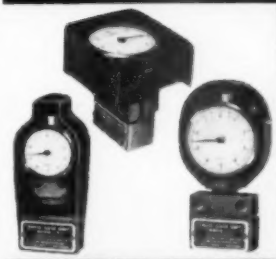

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O-M's special interlocking mechanism strips unnecessary bulk, does away with tie rods and out-sized end caps . . . saves up to ⅓ the installation space required by conventional-type cylinders of the same bore.

This internal locking feature means less maintenance, too. O-M cylinders are easier to clean, inspect, remove, disassemble and service, with no alignment problems in re-assembly.

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INDICATE A-12-160-1

the drill press quill. Workpieces are loaded and automatically positioned under the punch or drill for the machining operation. The table may be either hand loaded or hopper fed.

Two models of the automatic index feed are available. These feature a 12 or 15-in. table diameter with choice of 10 or 12 stations. Larger tables and up to 24 stations can be supplied upon special request.

Benchmaster Mfg. Co., 1835 W. Rosecrans Ave., Gardena, Calif. **T-12-1601**

Hobbing Machine

The Hamilton Tool Co., Ninth and Hanover Sts., Hamilton 4, Ohio, has developed an alternate design for its No. 1 small gear, precision hobbing machine. The new feature, which is

optional at no extra cost, adapts the machine to the use of existing tooling regardless of style or make of hobbing machine for which the tooling was constructed.

As a result of this feature, existing workholding fixtures may be utilized to obtain the Hamilton hobber's feature of independent selection of speeds, feeds and indexing. **T-12-1602**

Automatic Cutoff Unit

This compact, nonferrous metal cutoff machine, the Model M-16, offers both speed and precision results. In a specific application on brass solids of 1 sq. in. cross sectional area, it produces ⅝-in. pieces at the rate of 12,000 per 8-hour day.

It can be set up to cut any desired lengths. The machine has an automatic

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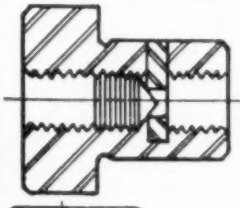

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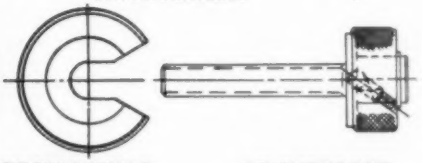

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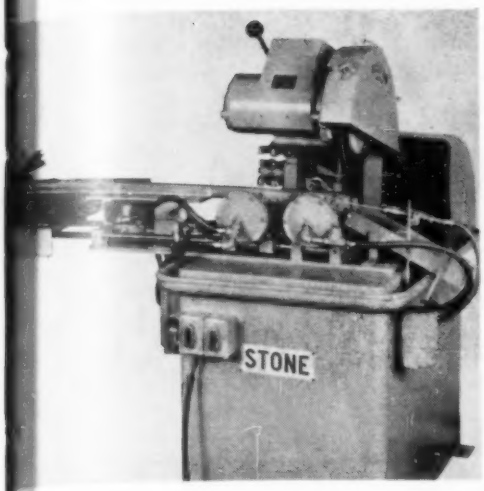
INDICATE A-12-160-2



feed for bar stock and turns out work with a milled-like finish. Fully automatic operation is also furnished by Stone Model M-75—a larger cutoff machine for ferrous metals using an abrasive cutoff wheel.

Stone Machinery Co., Inc., Manlius, N. Y. **T-12-1611**

Automatic Milling-Grinding Unit

Multiple-bladed milling cutters of regular or special shapes may be produced with the automatic milling and grinding machine manufactured by the Nederlandse Grossmann Co., Inc., Jupiterkade 10, The Hague, Holland. With this unit cutters are first milled and then ground simply by exchanging the milling for a grinding unit.

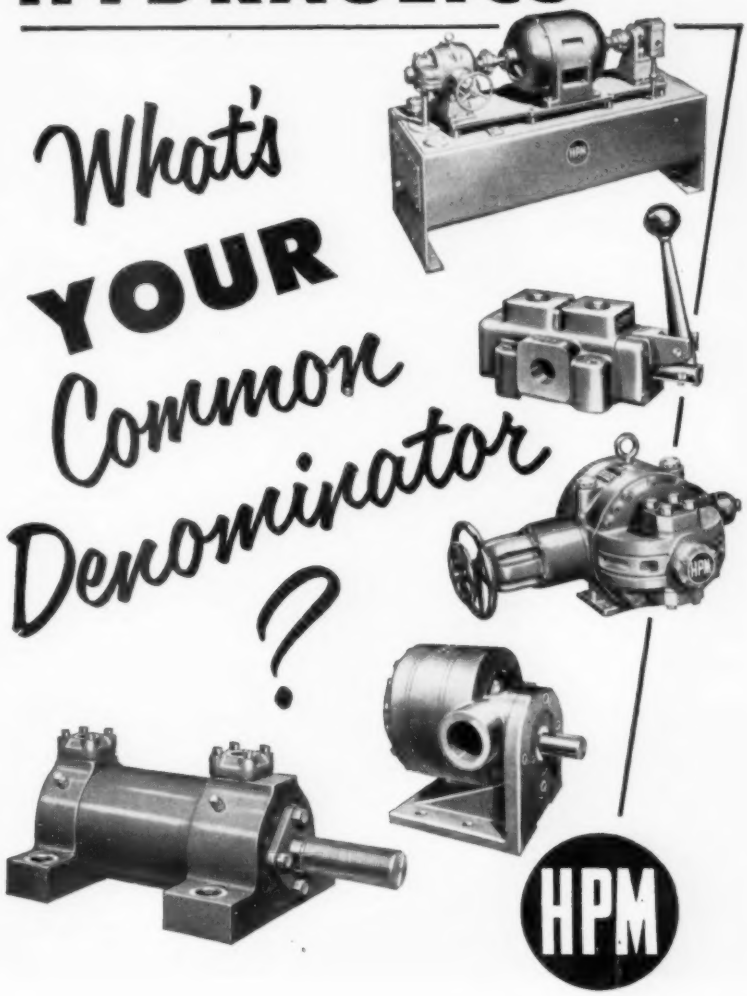
Dimensions of the work are maintained through control from a moving tapered tracer roll which passes over a copying template. Movement of the tracer roll over the template, lifting of the roll, replacement of the master pattern, and turning of the work are all performed automatically. Magnification of the copying device is 1:27 or 1:11. **T-12-1612**

Dial Type Milling Units

A line of dial type milling machines, more powerful than the former design, incorporates push buttons for easier operating.

The units are built in Nos. 2, 3 and 4 sizes and plain, universal and vertical styles for each size. To facilitate machining operations on light metals or on the newer, tougher alloys, they offer spindle speeds in a range from 18 to 1800 rpm for the No. 2 size, and 16 to 1600 rpm for the Nos. 3 and 4 sizes. Speeds are indicated by a large dial on

HYDRAULICS



Selecting the right hydraulic component for each requirement takes years of experience — years of hydraulic system design and application. Picking the right supplier for all your needs is another problem sometimes solved by using more than one source. The common denominator for all your hydraulic problems can be the product line and experience background of H-P-M. A complete line of pumps, power units, valves, cylinders and accessories plus 77 years of hydraulic experience is the answer in most cases. When you're planning hydraulically, call on H-P-M. Write today for Bulletin 1101 — the handy condensed catalog of the complete H-P-M line.

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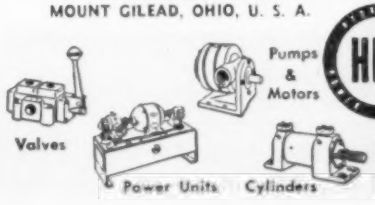

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the left-hand side of the column, and selected by two push buttons ("increase" and "decrease") at the console speed change, front of the knee, or at the left-hand side of the column as desired. There is no starting lever; push buttons start and stop the spindle drive.

Thirty-two feeds, from $\frac{3}{8}$ to 90 ipm. are selected by the turn of either of two knobs; one at the front and one at the rear operating stations. The feed indicator dial is clearly visible from either station. Power rapid traverse, both table and cross, is at the rate of 150 ipm. Feeds and rapid traverse are now powered by an independent 3-hp motor mounted on the knee.

Plain and vertical machines are available with and without automatic table cycles. Automatic cycle machines may be tooled up with one fixture for one-way single cycles, or fixtures at both ends of the table for two-way reciprocal milling, either continuous or with center safety stop. The latter type of cycle is possible because of an automatic backlash device.

The Cincinnati Milling Machine Co., Cincinnati 9, Ohio. **T-12-1621**

Magnifying Tool

A loupe for use on most machines, by attaching it to any type of stand or fixture, gives a 5X magnification to simplify accurate reading, inspection or

checking of work. It may be used at a convenient distance from the operator's eye, for safety and ease of eyestrain.

Englass Co., Inc., 57 Shady Way, Rochester 16, N. Y. **T-12-1622**

Automatic Welders

Equipment developed for hidden or submerged arc welding includes three welding heads, new controls and adjustments, new accessories, and two new power sources to give complete flexibility to Lincolnweld automatic apparatus.

The welding heads, LAF-3, LAF-4, LAF-5, offer a choice for either a-c or d-c current, field or shop welding, and constant potential or variable voltage power source. Choice of hot or cold instantaneous starting, either for intermittent welding or for precision starting is provided by the new operation controls which also permit choice of variable slow or fast inching speeds away from or to the work. The controls also allow choice of carriage operation to give stand-still starts, flying starts or manual control.

Head design permits easy adaptation to fixtures, either as a complete unit or

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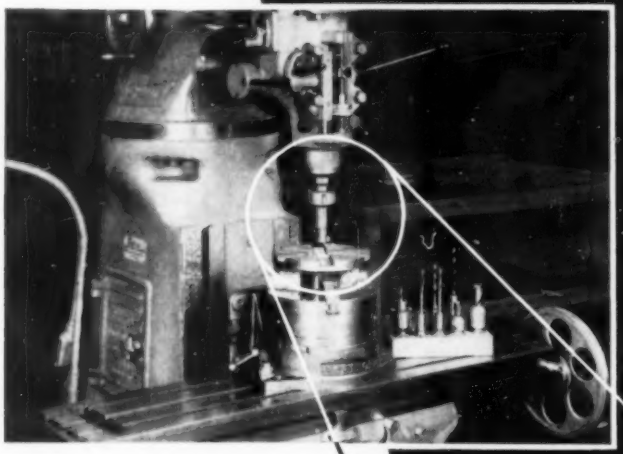
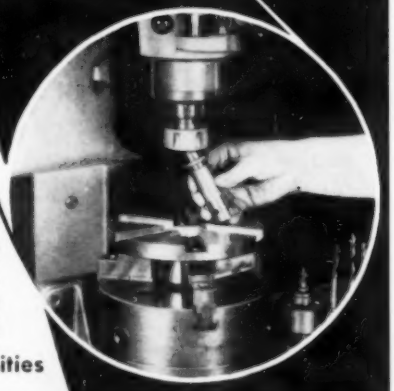


★ 80% saving in down time
★ Only ½ inch tool clearance needed
★ *Not* necessary to move table when changing tools
★ Eliminates loosening and tightening draw bolt

Tools completely eliminate the time lost in changing conventional type tools... Complete sets are available, write for literature covering specifications and price. Representatives in principal cities



PDQ PORTAGE Double-Quick TOOL CO.
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separate components. They can be positioned in any angle in three dimensions or off center for round-about welding, and can be positioned on seam while welding. Fine vertical adjustment up or down can be made while welding. Either welding jaws or a welding nozzle for more precise placing of flux can be used. Flux flow start or stop is simply controlled either automatically or manually.

Electrodes in sizes from 3/32 in. to 5/32 in. are handled by one set of drive rolls. A separate set of easily changeable rolls handles 5/64-in. diameter wire. A roller bearing wire straightener with a single adjusting screw can be swung 360 deg about a vertical axis to accommodate wire reels in any position.

The Lincolnweld AC-750 power course gives 750 amp continuous duty a-c power, and has a power-driven reactor control for setting current from remote switches.

Another power source is the Lincolnweld DC-750, designed for automatic welding. It is rated at 750 amp, continuous duty at 40 volts, and may be paralleled with a second DC-750 for work requiring higher amperages.

The Lincoln Electric Co., 22801 St. Clair Ave., Cleveland 17, Ohio

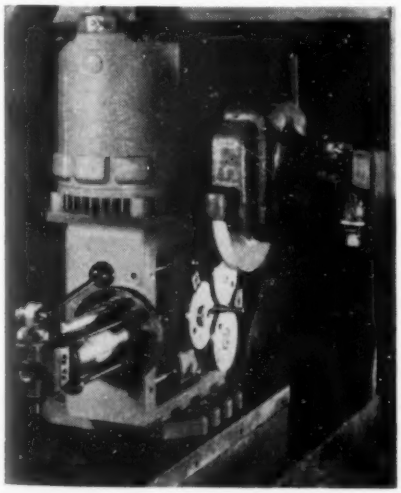
T-12-1631

USE READER SERVICE CARD ON PAGE 171 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Spin Roll Machine

Absolute concentricity and centering on inside and outside diameters up to 2 in., finished, is possible without the use of collets, chucks or centers through application of the new St. Mary's spin roll machine.

The unit, which converts a surface grinder to a universal grinder, is fully automatic, self-centering and self-ad-



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Standard Pressed Steel Company of Jenkintown, Pennsylvania is the world's largest manufacturer of Socket Screw Products, Cap Screws, Set Screws and a variety of other threaded fasteners. These SPS products are used on aircraft, home appliances, business machines, in fact, wherever products or components must be held together.
A continuing program of reseach and development at SPS assures a lasting place for the Company in America's future.

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justing to all uniform diameters and lengths.

A single quick adjustment permits change-over from one size work to another. There is automatic compensation for speeds and feeds while surface speed is constant for all diameters.

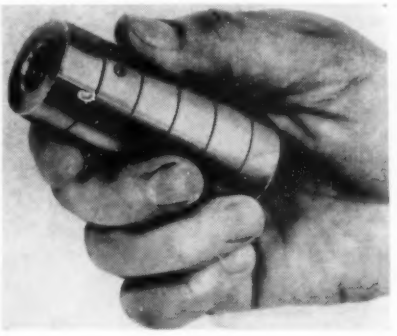
Its weight of only 65 lb permits easy portability, and it may be easily set up by one man in a matter of minutes.

Pivot Punch and Die Corp., North Tonawanda, N. Y. **T-12-1641**

Noise Eliminator

Quietaire pneumatic silencers, for use in preventing noise-shock from air-operated equipment, are available from C. W. Morris Co., 10628 Cloverdale, Detroit 4, Mich.

These compact, all-metal units, which reduce sound in noise-shock areas to



about 75 decibels, do not impair operating efficiency in any way.

There are no cartridges and no parts that need replacing. They are corrosion-resistant and are safe for any pressure normally encountered in industrial pneumatic service.

Produced in four easily attached models, Quietaire pneumatic silencers will fit almost all industrial air-operated equipment. **T-12-1642**

Motor Driven Micrometer

Direct measurements accurate to 0.00005 in. are obtained with the recently developed Model H Carson-Dice motor-driven electronically controlled precision micrometer. The actual dimensions of any electrically conductive part are read directly off this true screw-thread measuring instrument. Operation is automatic and at high speed. At the instant a setting is completed a green light glows under the index window. Automatic control is so sensitive and rapid in response that the micrometer is stopped before any pressure is exerted by the micrometer on

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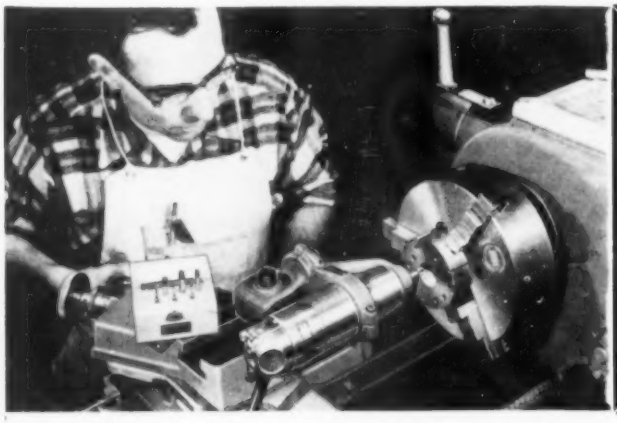

the POWER QUILL outperforms, outlasts the outmoded lathe grinder!

The Precise Power Quill is a small powerful high precision tool that outperforms and outlasts old fashioned lathe grinders, yet the Power Quill costs less! It can be mounted on any standard machine tool to mill, grind, or finish to tolerances of .0001". Operates at speeds up to 45,000 RPM, develops up to 1/2 H.P. and works on any material with abrasive wheels or tungsten carbide tools.

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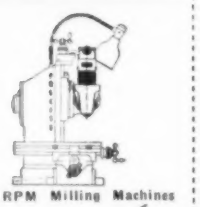
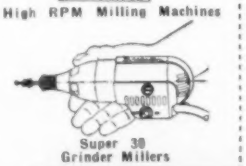


High RPM Milling Machines



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the work, permitting measurements to be made on fragile or flexible parts with the same speed and precision as for rigid parts.

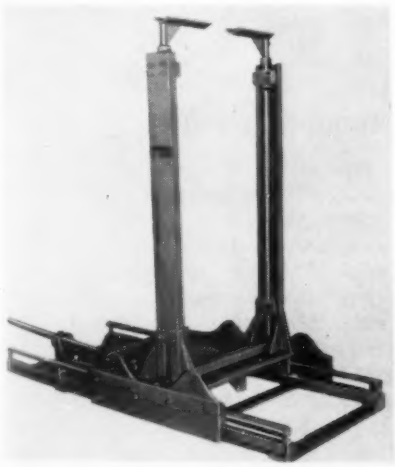
Maximum error, at maximum range, is less than 0.0001 in., and no more than 0.00005 in. for measurements under 0.250 in. Repeatability is 0.00002 in. at any reading. Range of micrometer screw is 1 in.; with standard micrometer tip, measuring range is $\frac{3}{4}$ in. Throat depth is 2 in. The standard anvil is easily removed for attachment of special fixtures. Upper head is adjustable on column over a range of 2 in. to accept work with a maximum dimension of 3 in.

J. W. Dice Co., Englewood, N. J.
T-12-1651

USE READER SERVICE CARD ON PAGE 171 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Transfer Unit

Wagner Brothers, Inc., 463 Midland Ave., Detroit, Mich., has introduced the Auto-Loader, an automatic parts transfer mechanism which can be adapted to any automatic metal-finishing mechanism operating with an intermittent motion.



Among the unit's main advantages are its sturdy construction which will withstand the heaviest loads; simplicity of design which minimizes maintenance requirements; and the design features which permit the Auto-Loader to accommodate a monorail conveyor system that operates on different planes.

In operation, the cycle of the Auto-Loader is controlled by limit switches of the automatic processing machinery, actuated by an hydraulic cylinder, or an electric drive, to move in timed unison with the transfer cycle of the automatic. Processed parts are unloaded from the automatic onto the monorail conveyor as unprocessed parts are loaded from the monorail onto the automatic.
T-12-1652

Duplicator for Small Lathe

The model 2-422 single motion type electronic duplicator is designed for use with small lathes to 16 in. capacity. Accurate to ± 0.0015 in., the unit operates with a stylus pressure of 8 oz permitting soft metal templates to be used. Standard tool bits may be used with the unit. Relatively unskilled personnel can operate the device which requires no gages or form tools. The duplicator may be readily attached to or removed from any lathe and does not interfere with the operation of the lathe when used for noncontouring work.

Because this duplicator is electronically controlled, there are no problems of valve wear, leakage or temperature change.

Similar duplicators are available in

for HEAVY DUTY and BOSSED DIES

Lamina
RING CLAMP GUIDE BUSHINGS

EXCLUSIVE HIGH-STRENGTH DESIGN

Lamina Ring Clamp Guide Bushings are designed expressly for use on heavy duty and bossed dies where large diameter pins are required. Due to the fact that the guide pin contacts the bushing at a point beyond the bearing face of the bushing head, the possibility of the head breaking off is eliminated.

SIMPLE, COST-SAVING ASSEMBLY

Like all other Lamina Guide Bushings, these heavy duty bushings are assembled with a wring fit in the shoe. Lamina Ring Clamp Bushings also are prefinished by precision honing at our plant. This not only eliminates distortion but saves considerable assembly time, effort and handling of large, heavy shoes.

AVAILABLE IN TWO MATERIALS

Lamina Ring Clamp Guide Bushings are available in both solid Ampco bronze and in hardened steel with bronze plated on the I.D. This latter bushing offers the ideal combination of long wear characteristic of hardened steel and the free-running action of bronze.

Lamina
DIES AND TOOLS, INC.
P.O. BOX 31, ROYAL OAK, MICHIGAN

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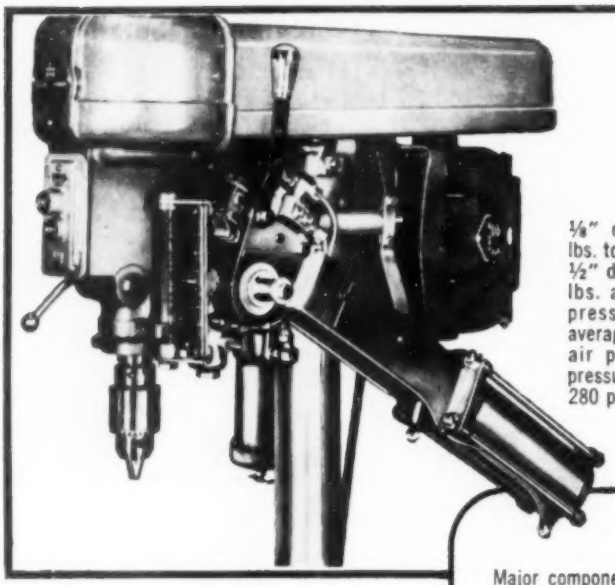
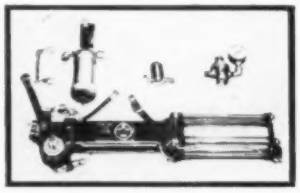


⅛" drill operates on 5 lbs. to 7 lbs. air pressure; ½" drill on 20 lbs. to 25 lbs. air pressure. Feed pressure at drill point averages 14x greater than air pressure, i. e. air pressure at 20 psi delivers 280 psi at drill point.

Major components of new W-T Air Feed. No "electrics". No "hydraulics". Installs in about 10 minutes, no machining necessary. Just connect to nearest air supply.



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AIR FEED DRILL PRESS

Ingenious Air Feed gives you AUTOMATIC CYCLING FOR PRODUCTION DRILLING — AT LOWEST POSSIBLE COST!

What does it cost? The W-T Air Feed Drill Press is available, ready for operation, at a surprisingly modest cost. For example: a W-T 15"-4" Travel Drill Press ***complete with motor and Air Feed*** is priced from $344.00. Or, if you prefer, you can get the Air Feed unit at only $185.50 to fit your W-T Drill Press (or any W-T type drill press up to 4" spindle travel). Compare these prices with any other Air Feed equipment!

Profitable? The W-T Air Feed is 100% pneumatic . . . requires virtually no maintenance . . . gives you fully dependable, low-cost, automatic performance day-in-and-day-out for a wide range of production operations, including drilling, reaming, counterboring, tapping, burring, spot-facing, etc. Fits as integral part of a drill press head, does not interfere with any function, swing or position of the machine.

Accurate? Complete, sensitive air feed control—including checking and slowing-down at several points as well as at the break-through point—is accomplished by ingenious, fool-proof micro-valve action. Just by positioning a valve stop, the spindle will feed and retard as desired, continuously and automatically—and the accuracy of the stroke will hold indefinitely within 0.003".

Available? Your local Distributor has W-T Drill Presses equipped with W-T Air Feed on demonstration right now. See them in action. You'll find your Walker-Turner Distributor listed under "Tools" in the yellow pages of your local telephone directory. Call him, today.

WALKER-TURNER

• DIVISION •

KEARNEY AND TRECKER CORPORATION

PLAINFIELD, N. J.

DRILL PRESSES—Hand and Power Feed • AIR FEED DRILL PRESS ATTACHMENT • RADIAL DRILLS • Wood and Metal Cutting BAND SAWS • TILTING ARBOR SAWS RADIAL SAWS • JIG SAWS • LATHES • SPINDLE SHAPERS • JOINTERS BELT AND DISC SURFACERS • FLEXIBLE SHAFT MACHINES

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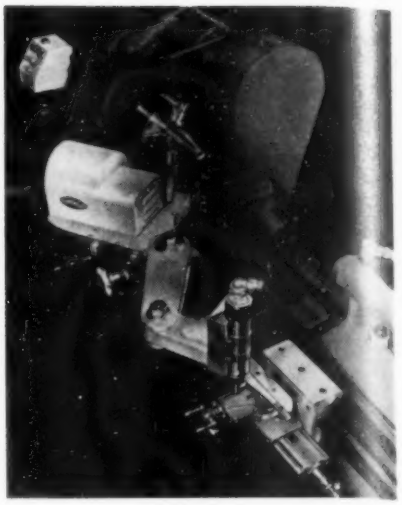


single motion contour to 90 deg; dual motion to 180 deg; and two motion to 360 deg for application with lathes, horizontal and vertical boring mills, millers and grinders.

Equipment Marking Div., Raytheon Mfg. Co., Waltham 54, Mass. **T-12-1661**

Grinding Head

A Multi-Spiral universal grinding head for use with cutter or surface grinders, or milling machines, simplifies difficult grinding jobs yet does not require elaborate setup. It is designed to permit universal motion in an infinite number of directions. Spindle motion is adjustable in and out on a straight line with the center line of the spindle. While in this motion the spindle can be set to any spiral lead, right or left hand. With the spindle moving in and out, the head may be set to move at right angles to the spindle motion, making it possible to grind tapers. Particularly suitable for grinding form relief, back-off work, straight or spiral flute-grinding, the unit also may be used for complete sharpening of most types of cutting tools.

Spiral Step Tool Co., 5404 N. Damen Ave., Chicago 25, Ill. **T-12-1662**

Aluminum Putty

Devcon F, which consists of approximately 80 percent aluminum and 20 percent plastic, may be used for repair, maintenance or corrective work on metal. Practical applications include filling holes in castings, covering incorrectly drilled holes or building up worn sections.

This new material is as easy to use as modeling clay and requires no special skill in handling. A large mass can be applied to a vertical surface and will

run or sag.

Adherence to aluminum and steel, as well as to bronze, brass, or cast iron, is excellent. It will bond to a flat surface and can be machined to a feather edge. Metal to which it is to be added need not be undercut or treated in any special way. No volatile solvents or thinners are used; therefore the Devcon will not shrink or pull away during hardening.

Regardless of the size of the mass used for a specific application, the material will harden naturally in 2 hours to a rigid, strong, tough piece of metal. Exposure to heat will shorten the hardening period to a few minutes. Once hardened, it is durable and permanent and will not crack or flake off during later machining.

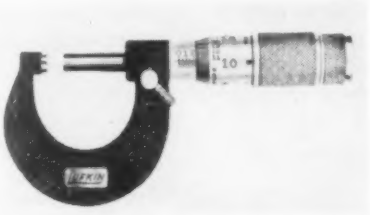
Repaired pieces can be blast treated with good results.

The substance also may be painted with standard coatings and then baked. It will not bubble, shrink or run at regular baking temperatures.

Chemical Development Corp., Danvers, Mass. **T-12-1671**

Cam Locking Device

A new Cam Lock feature makes Lufkin micrometer calipers easier and faster to operate, and holds the spindle more securely than the former knurled lock nut. Giving the lever ⅛ turn with



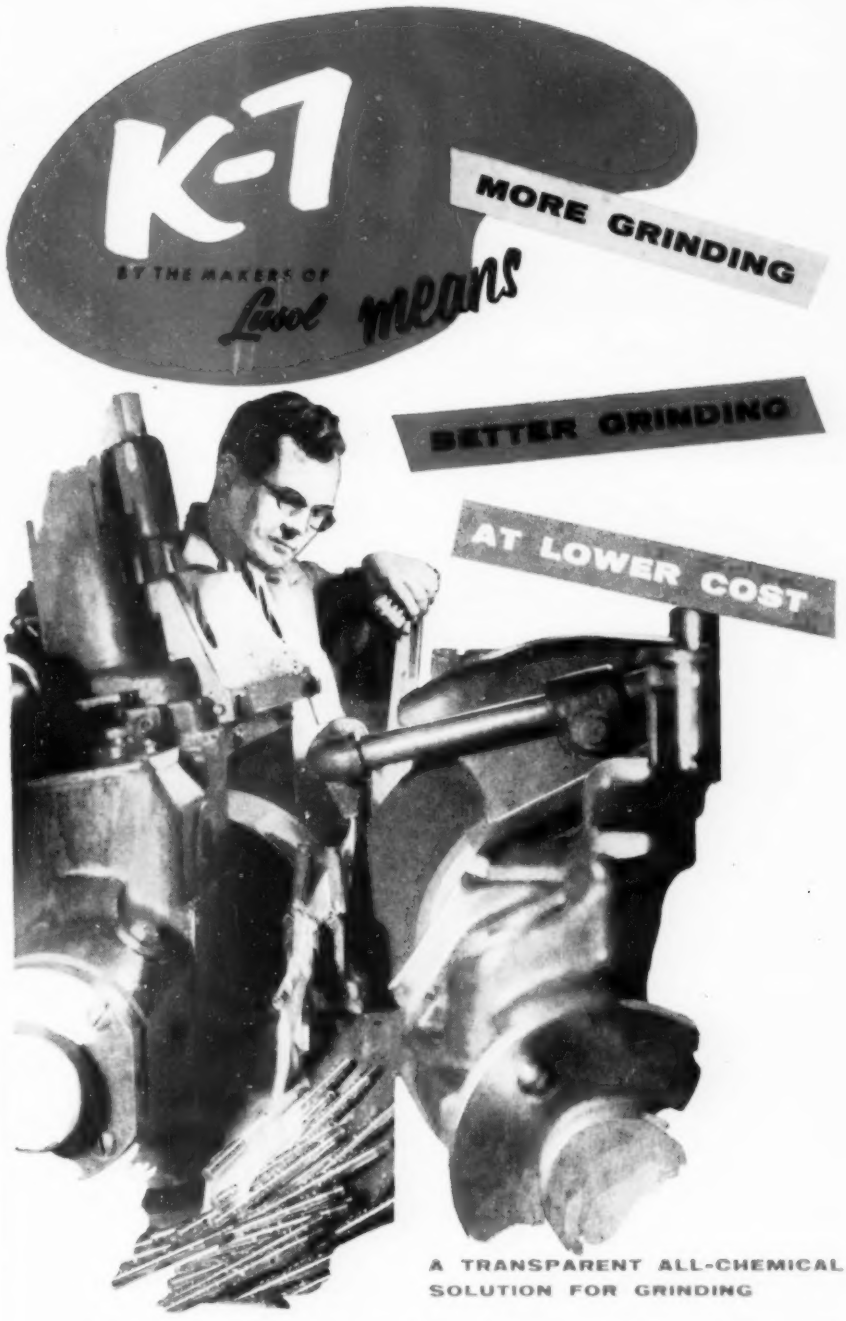
the thumb, securely locks or unlocks the spindle.

The Cam Lock now replaces the lock nut on 1600 and 1900 Series Lufkin micrometers.

The Lufkin Rule Co., Saginaw, Mich. **T-12-1672**

Hydraulic Shaper-Planer

A heavy-duty openside hydraulic shaper-planer is equipped with the new hydraulic Triple Circuit to provide the correct combination of cutting speed and force required to machine each type of materials most economically. Three distinct cutting ranges are available including high speeds for low cutting force; medium speeds for medium cutting force; and low speeds for heavy cutting force. Infinite speeds



A TRANSPARENT ALL-CHEMICAL SOLUTION FOR GRINDING

Lusol K-7 is a new all-chemical liquid concentrate designed for a wide variety of grinding operations. It is recommended for use on all steels and is particularly suited for cast and malleable irons, titanium, carbon, rubber, ceramics and plastics. Instantaneously soluable in any water, hard or soft, it forms a clear, transparent, colorless solution that resists contamination, settles chips super-fast, and remains clear after repeated use. It is non-foaming and runs absolutely flat under all conditions. It provides maximum rust protection for all ferrous metals, including cast and malleable irons. It maintains clean wheels at all times. They just don't load up when you use Lusol K-7. For better grinding every time, use Lusol K-7. Write for complete information.

THE Lusol LINE

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F. E. ANDERSON OIL CO., INC.

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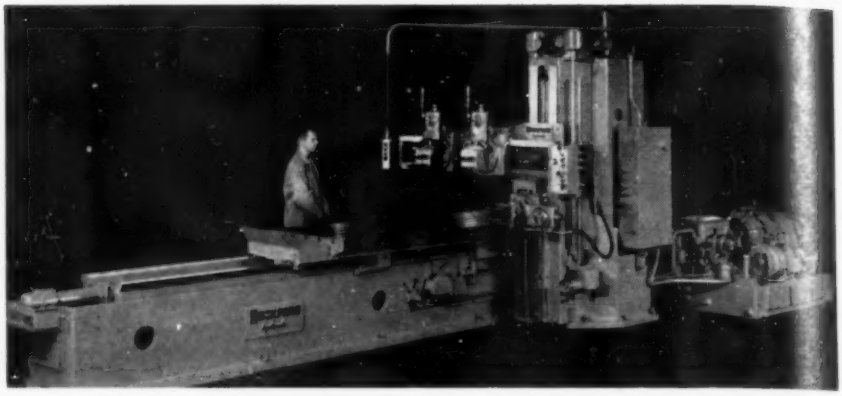
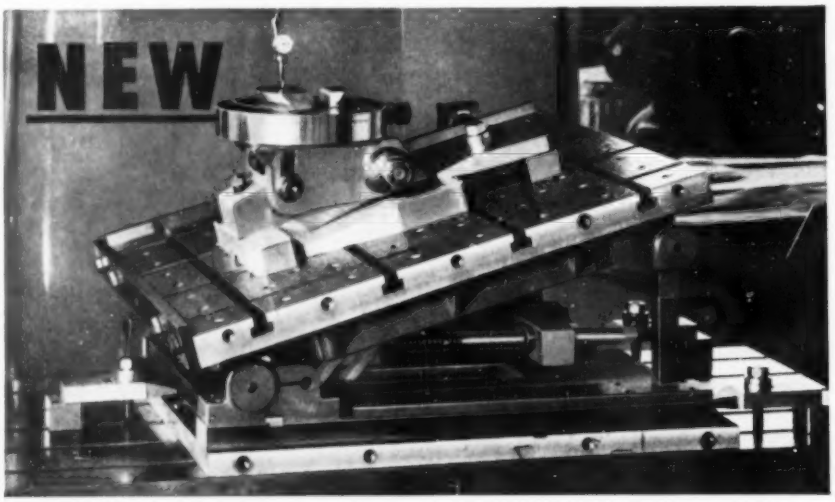
range from 10 to 300 fpm with maximum return speed regardless of cutting speed. Maximum cross feed and vertical feed to all heads is 0.500 in.

This addition to the manufacturer's shaper-planer line is built in 30 x 24, 30 x 30, 36 x 36 and 36 x 42-in. table sizes with stroke lengths from 6 to 20 ft, in increments of 2 ft. The machine has a heavy column with a long joint face for attaching to the bed. The wide, deep cross rail has a large bearing surface on the column ways.

Vertical feed engagement of the tool head permits better control by the operator. The tool head saddles, as well as the vertical feed slides, are equipped with adjustable double nuts, eliminating the problem of backlash and simplifying job setup. Tool heads have an inside clapper block arrangement and a positive abutment to take the thrust of the cut.



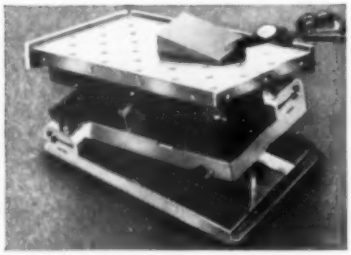
Rockford Machine Tool Co., Dept. X, 2400 Kishwaukee St., Rockford, Ill. **T-12-1681**



Robbins

SINE PLATE

WITH 24" x 24" WORKING AREA



Smaller Sine Plates are also available in models for both single and compound angles. Thousands are in daily use. Full details are in our illustrated catalog. Send for your free copy.

Designed on the sine bar principle, this husky new addition to the Robbins Sine Plate family provides gauge-block accuracy to angular set ups for very large, bulky work pieces. Any angle is quickly and accurately set up by inserting the correct standard gauge blocks between the top plate and the base of the unit.

In addition to the sturdy construction of these units, and to eliminate any possibility of dimensional inaccuracies due to distortion, gauge blocks are inserted at each side of the Sine Plate. Top plate is raised and lowered by a simple screw-type mechanism . . . positioning is simple, safe, sure.

Two of these Sine Plates used in combination also answer the need for any compound angle.

Complete information on these new extra-large Sine Plates or models built to specifications will gladly be forwarded upon your request.

OMER E. Robbins COMPANY

24800 PLYMOUTH ROAD • DEPT. E-4 • DETROIT 39, MICH.

Also producers of special gauges and fixtures

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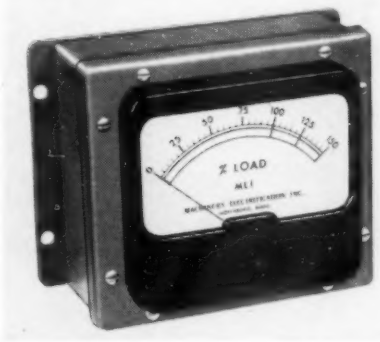
Motor Load Indicator

The MEK-2127 motor load indicator has an easy-to-read scale calibrated in either percent load or horsepower. Large color bands permit performance indications to be read at a glance. Needle waver, caused by mechanical



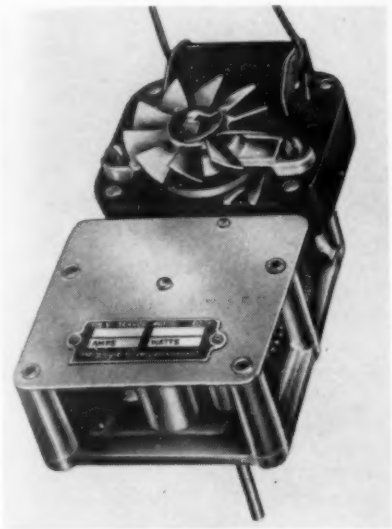
vibration or minor erratic load changes, is reduced because the instrument is highly damped.

The conversion unit may be mounted near the motor starter and light control wires can be connected to the indicator. Dual voltage units are adjustable for operation on either 220 or 440-volt systems. Special scales can be supplied for any type motor or load.

Machinery Electrification, Inc., Dept. SRR, Northboro, Mass. **T-12-1682**

Miniature Geared Motor

A geared motor, designed for use in actuating devices and similar applications, is a compact, powerful subfractional horsepower speed reducer powered by a 2-pole shaded pole induction



motor and equipped with a fan for cool operation under high temperature conditions. Horsepower of the basic motor is available from 1/500 to 1/75, with output speeds available from 1 rpm and faster. The basic induction motor is also available without the gear housing.

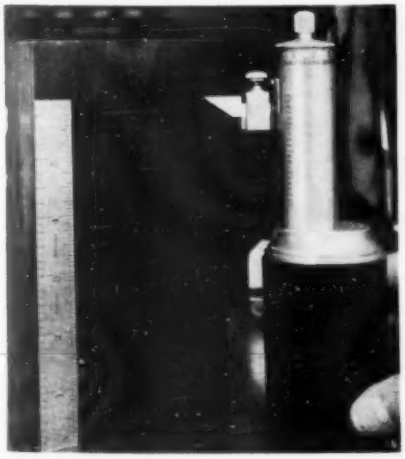
Loyd Scruggs Co., Festus, Mo.

T-12-1691

Micro-Height Gage

The Micro-Height gage, manufactured by The Greist Mfg. Co., New Haven, Conn., is used for fast and accurate laying out and inspecting of metal dies. It is read in the same manner as a micrometer without further calculations of any kind.

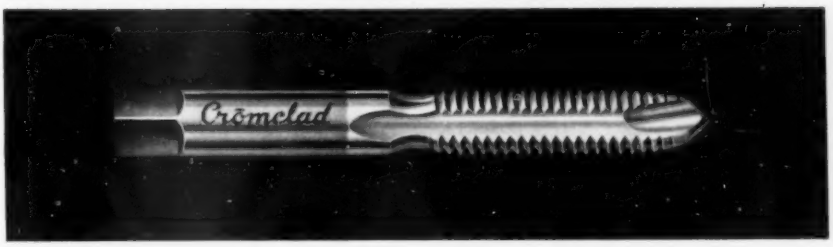
The basic gage has a 2-in. direct



Let's cut out the

DOUBLE TALK

. . . about **TAPS**



Let's all admit a few general facts:

- There are some 23 tap manufacturers in the U.S., all making ground thread high speed steel taps of excellent quality — properly hardened, accurately ground, carefully inspected.
- They're *all* sharp, uniform, accurate, rugged, controlled and dependable.
- Everyone knows that taps from one good manufacturer will perform pretty much like taps from *almost any other good manufacturer.*

So what can be said, more, about **TAPS?**
Briefly . . . and it's **news** *to you . . . there's this:*

1. Crōmclad Taps have a special hard chrome surface treatment (less than .00005″ thick) developed by us specifically for taps.
2. This unique Crōmclad treatment reduces friction, loading and metal seizure — resulting in a substantial increase in tap life.
3. Crōmclad treatment differs from conventional chrome plating in that it will not peel or chip even after sharpening.
4. Slippery-smooth, free-cutting action permits Crōmclad taps to cut closer to their own size under normal conditions.
5. Unconditional guarantee goes with Crōmclad Taps. If they do not perform to your satisfaction, they may be returned for full credit.
6. Crōmclad Taps are sold *at no extra cost* over conventional ground thread high speed steel taps.
7. *Attractive quantity discounts* are available on an *above-board* basis, quoted openly in our price list.

Crōmclad TAPS

We invite you to read these 7 points over again — then mail coupon today for detailed price list.

NEW ENGLAND TAP CO. 1 Endicott St., Norwood, Mass.

Send price list on Crōmclad Taps to

Person_____

Company_____

Street_____

City & State_____

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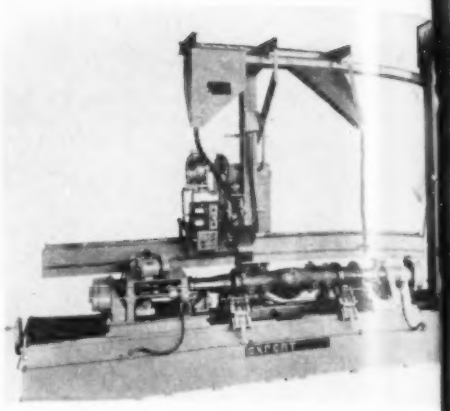
reading in thousandths which is easily increased to 3 in. by reversing the scriber. By adding a 3-in. riser to the base, as shown in the illustration, the gage's capacity extends to 6 in. To determine distances between heights or holes, the steel scriber is replaced by a dial indicator.

Patent rights to the Micro-Height gage recently were purchased by Greist from the Fairfield Gauge Co. of Bridgeport, Conn., and are distributed nationally through industrial supply houses. **T-12-1701**

Shielded-Arc Welder

Circular welds on large round assemblies up to 13 ft long are produced with this general-purpose, semiautomatic, shielded-arc welding machine.

A 19-ft long steel bed supports a variety of fixtures that are moved along the bed to suit assembly length variations. Fixtures have a motor-driven headstock, tailstock with live center, rest blocks for supporting the parts during loading and roller steady rests that support parts during welding. Axial



motion of both head and tailstocks is controlled by air cylinders.

After circular parts to be welded are positioned on the fixture rest blocks, head and tailstock centers are advanced by their air cylinder controls to hold the parts firmly in correct location during welding. Because of the design, the tailstock center moves to a fixed predetermined location while the headstock center adjusts itself to expansion variations of the assembly during welding.

Push-button controls for the two motor drives on the head operate to bring the welding head to correct vertical and forward location to accomplish the proper weld. Fractional horsepower motor and lead-screw drives power the in-and-out and up-and-down head motions.

With the welding head positioned, the assembly is rotated by a ½-hp motor during the preheating and welding operation. When the area to be welded is sufficiently preheated, the welding operation is initiated. Flux is automatically gravity fed to the weld area from a hopper, while welding wire advances automatically during assembly rotation. This welding operation is continued for one or more passes until the desired amount of weld deposit is attained.

Excess flux falls onto a mechanical oscillating conveyor under the fixture, and is moved by the oscillating conveyor to one end of the machine.

Expert Welding Machine Co., 17144 Mt. Elliott Avenue, Detroit 12, Mich. **T-12-1702**

Special Purpose Wet Blast Equipment

A rotary automatic unit, designed for fast production cleaning of electronic receiving tube leads in order to assure a good joint, is capable of blast cleaning, rinsing, drying and unloading at the rate of approximately 1200 parts per hour. Use of this wet blast method in this case has replaced

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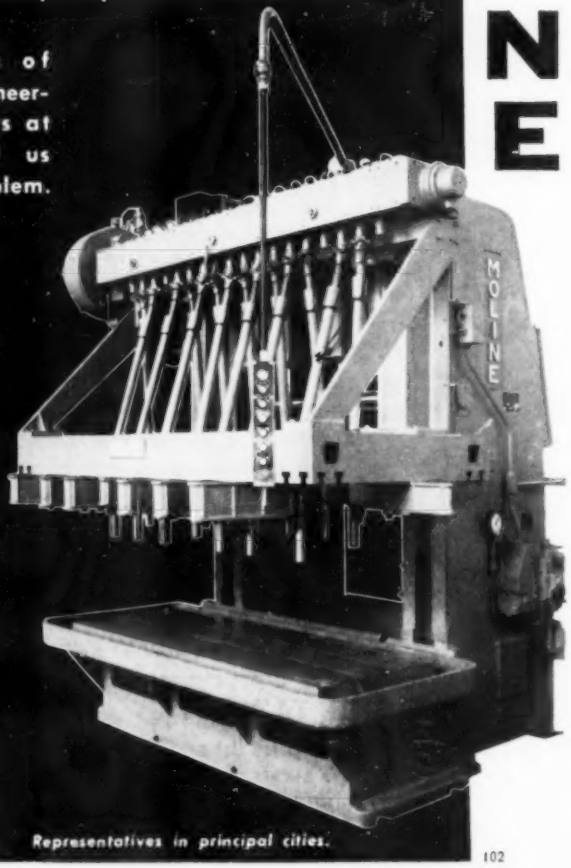
- Single and Multi-Spindle Honing
- Straight Line Multi-Drilling
- Adjustable Spindle Drilling
- Vertical and Way-Type Fixed Center Drilling, Boring and Tapping
- Special Multiple Operation Machine Tools

Over 50 years of Machine Tool Engineering experience is at your service. Tell us your particular problem.

MOLINE



HU68 drilling machine with fourteen spindles adjustable in a 72 inch by 24 inch drilling area. Other sizes available.

MOLINE TOOL CO. HOLE-HOG MOLINE, ILLINOIS

Representatives in principal cities.

102

MOLINE TOOL COMPANY
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TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

Literature Number	COMPANY	DESCRIPTION
A-12-226	Ace Drill Bushing Co., Inc.	**Drill Bushings**—Catalog G describes a variety of sizes and types available. (Page 226)
A-12-237	Allen Mfg. Co.	**Socket Cap Screws**—General catalog G55 contains stock listings and advantages of fastener experiences. (Page 237)
A-12-23	The American Brass Co.	**Drawing Brass**—Booklet B-39 contains information on the workability of Formbrite. (Page 23)
A-12-190	American Broach & Machine Co.	**Broaching Machines**—Catalog 450 describes broaching the "American" way. (Page 190)
A-12-13	American Drill Bushing Co.	**Drill Bushings**—Catalog indicates the wide range of bushings and location of nearest distributor. (Page 13)
A-12-216-2	American Machine & Foundry Co.	**Drill Press Vise**—Fourteen-page folder on instant-change drill press vises. (Page 216)
A-12-183	B. C. Ames Co.	**Dial Indicators**—Catalog describes the Ames line of indicators and gages. (Page 183)
A-12-178	Armstrong-Blum Mfg. Co.	**Metal Saws**—Catalog C-55 contains data on Marvel saws and high-speed saw blades. (Page 178)
A-12-214	The Atrax Co.	**Carbide Tools**—Eighty-eight-page catalog on carbide tools, including selection tables and recommended applications. (Page 214)
A-12-194-1	Barksdale Valves	**Air Valves**—Folder 2801 contains information on new 'Shear-Seal' Air Valves. (Page 194)
A-12-48	The Blanchard Machine Co.	**Surface Grinding**—Data on surface grinding or Blanchard machines. (Page 48)
A-12-42	Boston Gear Works	**Motor Gearing**—New catalog R-56 lists information on reductors and ratiomotors. (Page 42)
A-12-56	Campbell Machine Div. American Chain & Cable	**Abrasives**—Abrasive cutting principles described in bulletin DH-301. (Page 56)
A-12-33	Carboloy, Dept. of General Electric	**Carbide Equipped Dies**—Manual D-124 contains data on die engineering. (Page 33)
A-12-242-3	Chicago Rivet & Machine Co.	**Rivet Setters**—Engineering information and rivet specifications plus illustrated descriptions of automatic rivet setters. (Page 242)
A-12-250-3	Comtor Co.	**Gaging**—Easy precision gaging described in Bulletin 48. (Page 250)
A-12-159	A. G. Davis Gage & Engineering Co.	**Gage Components**—Catalog No. 8 on Davis gage components. (Page 159)
A-12-250-1	J. Arthur Deakin & Son	**Die-Sinkers**—Catalog D gives data on the Deakin line of British machines. (Page 250)
A-12-53	DeVlieg Machine Co.	**Jigmils**—New 2B-36 Spiramatic Jigmil described in illustrated catalog. (Page 53)
A-12-10	Dow Chemical Co.	**Magnesium Tooling Plate**—Three booklets on the use of magnesium tooling plates in industry. (Page 10)
A-12-267	Eastman Kodak Co.	**Contour Projectors**—Booklet describing the Kodak contour projectors and their numerous uses. (Page 267)
A-12-258-3	Elgin National Watch Co.	**Rotary Tools**—Free booklet on Elgin Golden-Circle rotary tools. (Page 258)
A-12-153	Ettco Tool Co., Inc.	**Screw Tapping**—Booklet showing advantages on both single and multiple spindle operations. (Page 153)
A-12-234-1	The J. C. Glenzer Co., Inc.	**Live Centers**—Index Circular D contains data on live centers. (Page 234)
A-12-231	Hanna Engineering Works	**Valves**—Hanna valve catalog No. 254 includes descriptions and specifications of hydraulic and air valves. (Page 231)
A-12-246	Haynes Stellite Co. A Division of Union Carbide and Carbon Corp.	**Metalcutting Tools**—Descriptions of properties, sizes and recommended operating data are contained in booklet. (Page 246)
A-12-IFC	The Heald Machine Co.	**Chucking Machine**—Heald Model 170 automatic chucking machine is described in Bulletin 2-170-T. (Inside Front Cover)

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A-12-161	Hydraulic Press Mfg. Co.	**Hydraulic Components**—Condensed catalog of the H-P-M line. (Page 161)
A-12-186	Jacobs Mfg. Co.	**Chucks**—Spindle-Nose lathe chucks are described in Bulletin 54A-LC. (Page 186)
A-12-243	Kearney & Trecker Corp. Special Machinery Div.	**Machine Tools**—Booklet No. 1067 contains many solutions on metalworking problems. (Page 243)
A-12-8	Landis Machine Co.	**Thread Rolling**—Advantages of Lanroll attachments are described in Bulletin G-96. (Page 8)
A-12-229	Lucas Machine Div. The New Britain Machine Co.	**Machine Tools**—New catalog containing data on Lucas machines, now available. (Page 229)
A-12-203	Melin Tool Co., Inc.	**Cutting Tools**—New Melin tool catalog and price sheet available. (Page 203)
A-12-225	The Monarch Machine Tool Co.	**Ready-Set Tooling**—Illustrated Quik-Tool booklet No. 306 shows possibilities of immediate tool changes. (Page 225)
A-12-65	Oakite Products, Inc.	**Barrel Finishes**—Ten-page booklet gives data to improve barrel-finished surfaces. (Page 65)
A-12-72	The Ohio Crankshaft Co.	**Induction Heating**—Booklet contains information on induction heating for forming and forging. (Page 72)
A-12-184	O'Neil-Irwin Mfg. Co.	**Precision Shearing**—Catalog gives details on both hand and power shears and other Di-Acro products. (Page 184)
A-12-174	The Parker Stamp Works, Inc.	**Marking Machines**—Literature on the complete line of Parker marking machines and accessories. (Page 174)
A-12-52	Pioneer Tool Engineering, Inc.	**Cast Aluminum Tooling Plate**—Catalog 921-T shows applications, mechanical properties and sizes for use in jigs, fixtures, dies and special machinery. (Page 52)
A-12-239	The Pipe Machinery Co.	**Gages**—Catalog No. 10 contains information on internal and external thread gages. (Page 239)
A-12-67	R and L Tools	**Cutting Tools and Components**—Catalog tells the precision and time-saving qualities obtainable with R and L tools. (Page 67)
A-12-152	Ring Punch & Die Co.	**Punches and Dies**—Catalog No. 104 contains data on Ring standardized punches and dies. (Page 152)
A-12-191	The Rotor Tool Co.	**Rotary Tools**—Bulletin 43 contains information on Rotor D-4 air grinder and other Rotor tools. (Page 191)
A-12-200	Sheldon Machine Co., Inc.	**Lathes**—Catalog G-55 shows new 10", 11" and 13" swing, bench, cabinet and pedestal mounted lathes. (Page 200)
A-12-27	The L. S. Starrett Co.	**Measuring Tools**—New catalog contains descriptive literature on Starrett products. (Page 27)
A-12-150	Sutton Tool Co.	**Collet Chucks**—Practical applications of Levermatic chucks are contained in catalog. (Page 150)
A-12-204	The Tomkins-Johnson Co.	**Rivitors and Clinchors**—Write for Clinchor Bulletin 847 and Rivitor Bulletins 646 and 847. (Page 204)
A-12-62	The Torrington Co.	**Swaging Machines**—Detailed description of rotary swagers and their capabilities. (Page 62)
A-12-198	Tracer Control Co.	**Tracer Control**—Catalog on controlling standard machines for contour machining operations. (Page 198)
A-12-66	Verson Allsteel Press Co.	**Presses**—Catalogs available describing the Verson line of presses. (Page 66)
A-12-199	Waldes Kohinoor, Inc.	**Grooving Tools**—Twenty-page manual contains information on Waldes Truarc Grooving Tool. (Page 199)
A-12-228-2	West Point Mfg. Co.	**Toggle Clamps**—Work-holding clamps are described in catalog. (Page 228)
A-12-185-1	Willey's Carbide Tool Co.	**Tungsten Carbide Tools**—A variety of carbide tools are discussed in three booklets. (Page 185)

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New!

MICRO-ALIGNMENT
TELESCOPE

Zero-focusing—for alignment of all points at any distance; increased micrometer range, improved focusing drum for quick, convenient finding, improved auto-reflection and auto-collimation equipment for precise squareness setting.

New!

MICROPTIC LEVEL
B131A MARK III

Improved optics, fully kynematic mount for protected precision bubble, tested to .002" in 100 ft., the universal optical tooling level.

A COMPLETE RANGE OF
PROVEN EQUIPMENT

PRECISION AUTO-COLLIMATORS for all engineering applications.

CLINOMETERS (angle gages) and PRECISION LEVELS.

ROTARY TABLES (projection type) and PRECISION TESTERS for circular spacings.

DIVIDING HEADS (optical)—projection type and laboratory type.

MEASURING MACHINES—all types.

UNIVERSAL MICROSCOPES for all shop inspection and production uses.

PRECISION SCALES—linear and circular—glass and metal.

Write for complete information on any of these instruments to Dept. T-125.

ENGIS
EQUIPMENT CO.
431 S. Dearborn St., Chicago 5, Ill.

INDICATE A-12-173-1

all chemical cleaning.

Mounted vertically within the cabinet is a 6-station, air-operated rotary indexing table to which 6 vertically positioned work-holding spindles are attached. Each spindle supports a chuck, which, in turn, carries the tubes through each of the separate, baffled operating stations.

Use of different work-holding fixtures adapts the unit to the finishing of a wide variety of other parts.

Cro-Plate Co., Inc., Hartford, Conn.
T-12-1731

Constant-Voltage Welder

A line of 500, 750 and 1200-amp constant-voltage welders which are designed to allow the operator to select the most suitable arc voltage for a job at hand, is being made by the Glenn Co., Oakland, Calif., and is available through The Harnischfeger Corp., Milwaukee 46, Wis. The voltage remains constant

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OF THE RIGHT
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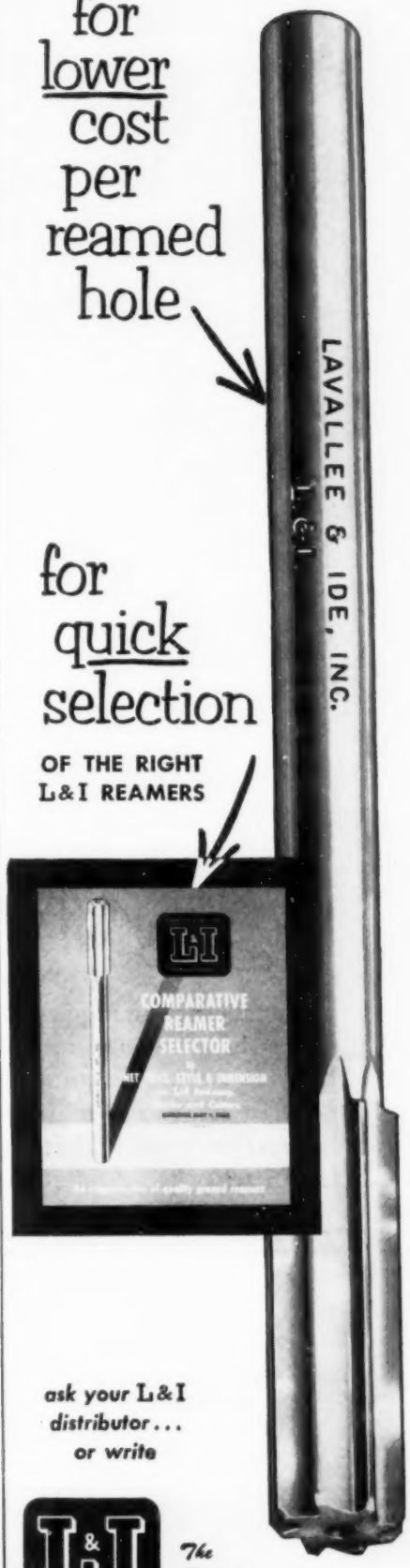

ask your L&I distributor . . . or write

L&I *The Reamer Specialists*

LAVALLEE & IDE, INC.
CHICOPEE, MASS.

INDICATE A-12-173-2

SPECIAL MARKING MACHINES

by Parker

Vaccinate HYPODERMIC NEEDLES

. . . by the thousands . . . with precision
. . . and economy!

Pharmaceutical people lay down the most exacting requirements. That's why Parker was given the challenge to design and build this super-special marking machine. Dial operated, it marked 60 needle holders per minute—no trial and error—every impression perfect! That's our story. What's your problem? Parker can do the same for you.

To protect your **MARKET . . . Mark it!**

Send today for literature on the complete line of Parker marking machines and accessories.

THE PARKER STAMP WORKS, INC.
MARKING DIE & MACHINERY DIV.
PRANKLIN AVENUE • HARTFORD, CONNECTICUT

by Parker

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during the entire welding cycle. Simply setting the correct rod feed and travel rate produces the desired deposit rate. The constant-voltage feature assures uniform deposit, while arc voltage, rod speed and travel rate all remain constant.

Weld quality is further improved because starting and recovery are instantaneous even where tack welds and areas of poor fit-up are encountered.

T-12-1741

Contour Milling Cutters

A method of automatically grinding the final shape of teeth of contour milling cutters after hardening without the errors and inaccuracies often resulting from conventional hardening processes has been developed by Homestrand, Inc., 9 Addison St., Larchmont, N. Y. In addition to providing accuracy, the special equipment used permits rapid, economical production of large or small quantities of identical cutters with any tooth shape except those containing concave curves of less than $\frac{3}{8}$ in.

The cutters can be resharpened on the face of each tooth without changing the established contour, and all cutters are available with chip clearance on the sides as well as on the tops of the teeth. Standard size blanks are available in widths from $\frac{1}{8}$ to $\frac{3}{4}$ in. and diameters from $2\frac{1}{4}$ to 4 in. They also can be supplied specially up to 4 in. in diam.

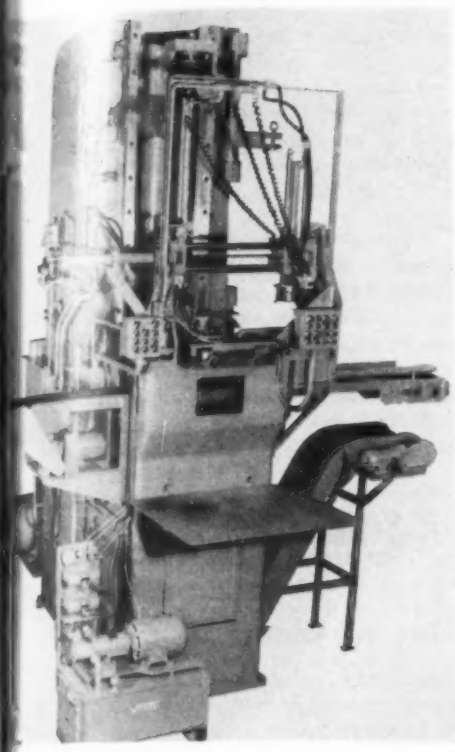
T-12-1742

USE READER SERVICE CARD ON PAGE 171 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Special Purpose Broaching Unit

This 30-ton, 60-in. stroke pull-down broaching machine automatically broaches ten internal splines in an automotive brake drum in one pass.

A hydraulically operated loading mechanism with an internal chucking device picks up the part off the conveyor line, and transfers it across to the sliding work-holding fixture. The collet type fixture automatically clamps the part and moves it into broaching position. The broach is pulled down through the part, broaching ten 1-in. wide splines in the workpiece. At the end of the broaching stroke the slide moves out, automatically ejecting the part back onto the belt conveyor. The broach returns to starting position. During the broaching and return stroke the loading unit moves across on guide rails, picks up another part from the conveyor line and returns ready to reload the work fixture. The machine



runs continuously on automatic cycle as long as parts are coming in from the conveyor line.

An automatic conveyor unit disposes of chips. A full follow-up retriever mechanism follows the broach through the stroke.

American Broach and Machine Co., Div. of Sundstrand Machine Tool Co., Ann Arbor, Mich. **T-12-1751**

Cam Making Unit

A unit called Curvomat, has been developed which produces cams through geometric action of three compounded slides to assure lobes with a consistent rise through every 0.01 segment. The surface profile is generated in a continuous, sweeping motion with neither fast nor slow intervals. A second major feature of the machine is that it will produce an accurate cam directly from engineering computations without any drawings, templates or preliminary layout. Because calibrations are inherent in the unit itself, there is no need for a blank to be stamped in 0.01 intervals.

This self-contained Curvomat may be mounted on the milling machine, grinder or drill press to be used, although it is not geared, linked or synchronized to that tool. Because it is easily mounted, the machine to which it is attached is not confined to cam production.

Bradley Machinery Sales Co., Inc., 23440 Woodward Ave., Detroit 20, Mich. **T-12-1752**

Radial Drilling Unit

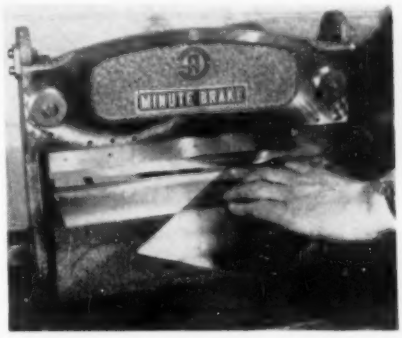
A low-cost 40-in. Arboga radial drill is designed with a direct gear drive motor and a #4 taper in the spindle providing drilling capacity of 1¾ in. Among features of the unit is the drill ejector which is integral with the spindle which allows drills to be removed without the use of a drift punch.

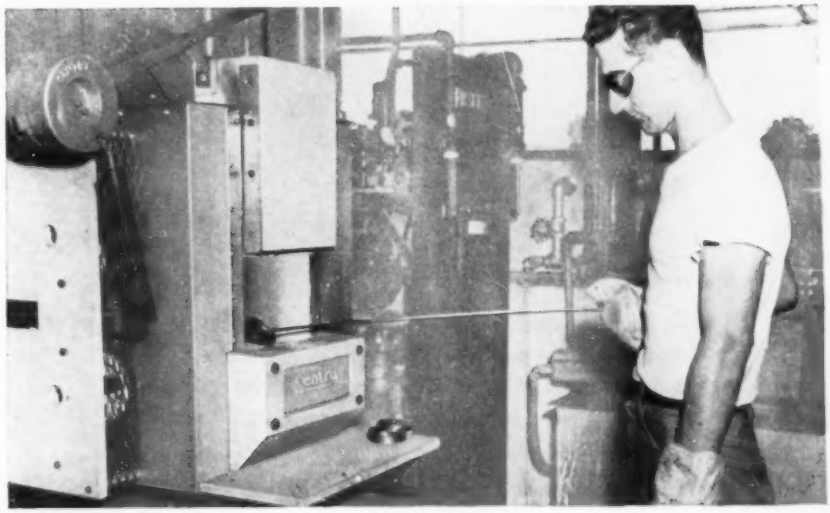
Construction of the machine provides rigid operation even when the drill head is used at the maximum radius from the column. All controls are centrally located for operator ease and efficiency.

Distributed by Masters' with Arboga, 118-122 Church St., Newton, Ohio or Masters' Precision Tools, 3613 Archer, Chicago 9, Ill. **T-12-1753**

Small Brake

A versatile, high quality 12-in. brake with an added shearing feature has been designed especially for model shops, experimental laboratories and





SENTRY Guarantees Quality Controlled Tool Hardening

The Parsons Tool Company, Berlin, Conn., heat treats many items for many customers — each customer requiring a perfect job. Circular form tools (such as shown here), dies and all kinds of high speed steel tools are regularly hardened with consistent high quality.

With so many customers to please, an absolutely reliable furnace was required — and the Sentry Furnace became the obvious choice. The Sentry Diamond Block Method of Atmospheric Control has repeatedly proved itself, guaranteeing complete freedom from scale, decarburization or other surface deterioration.

Sentry Furnaces successfully heat treat all kinds of high speed and air hardening steels.

Request Catalog M-46

Tells the full story of Sentry Furnaces and The Sentry Diamond Block Method.

Sentry ELECTRIC FURNACES

THE SENTRY CO. • FOXBORO • MASS.

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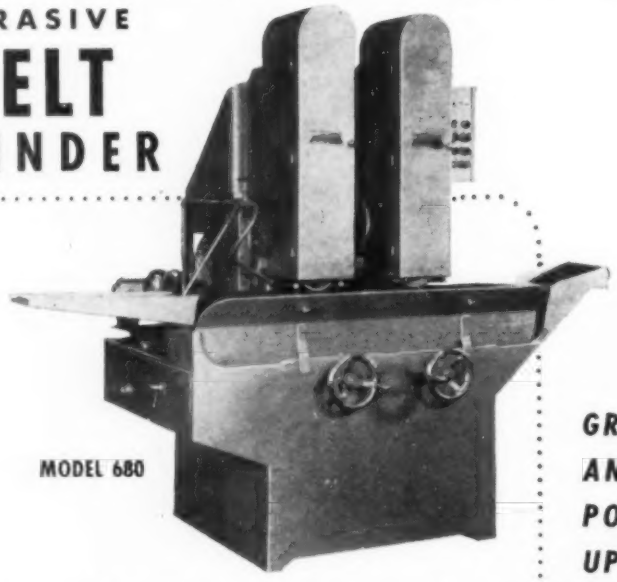
New ENGELBERG

MULTIPLE-HEAD, CONVEYOR-TYPE

ABRASIVE

BELT GRINDER



MODEL 680

GRINDS AND POLISHES UP TO

100% FASTER

(or more!)

Here is a high-production, semi-automatic abrasive belt machine for precision finishing of any flat and many irregularly shaped surfaces. Works on *any* ferrous, non-ferrous, plastic or other material.

Operating wet or dry, the Model 680 increases production up to 100% and more, over conventional grinders. You may simplify fixtures — or eliminate them entirely. Set-up time is reduced substantially: a big saving where short runs are common.

Multiple heads allow you to combine operations which would otherwise be done on several machines or through repeated set-ups of one machine. Single, double or any number of heads are available, powered by 5 or 7½ hp drive — with or without magnetic chuck.

THE ENGELBERG HULLER CO., INC.

SEND US a sample piece or print for cost-and-time-savings estimate. Or ask to have one of our production engineers call to discuss your grinding problems. No charge —no obligation.

THE ENGELBERG HULLER CO., INC.
312 Seneca St., Syracuse, N. Y.

Please send complete information on new Model 680 Multiple-Head, Conveyor-Type Abrasive-Belt Grinder, and name of nearest distributor.

- NAME_____
- FIRM_____
- ADDRESS_____
- CITY_____ ZONE_____ STATE_____

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production departments where space is an important factor.

Despite its small size, this machine is capable of developing 4½ tons of force in such operations as hemming, internal notching, bending, flattening, corrugating, louvering and boxing. It will shear 12 in. long mild steel up to 14 ga.

Construction feature of this unit, called the Minute Brake, is a standard handle which is interchangeable for either left or right-hand use; a second handle may be adapted for two-handed operation. Instant change standard dies, shear blades and stand are available.

Rotex Punch Co., 2350 Alvarado St., San Leandro, Calif. **T-12-1761**

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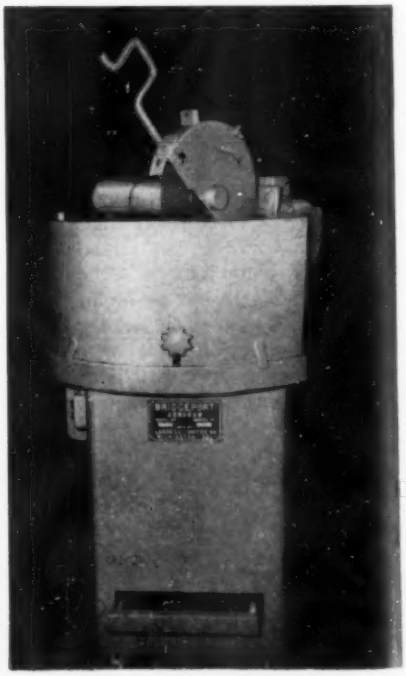
Abrasive Cutoff Unit

Automatic operation of almost any degree is possible with the Model 48-W Bridgeport abrasive cutoff machine. An air cylinder and hydrocheck actuate the head, saving labor and reducing wheel costs (16-in. diam. wheel). A vise is also operated by the air cylinder. For safety, head and vise operation is integrated. Feeding mechanism, which grips material to be cut, moves it into position. A series of limit switches tie these operations into a smooth cycle which repeats automatically. Both ends of the piece being cut are held by vise. Coolant is applied equally to both sides of cut.

United Engineering and Foundry Co., Wilmington 99, Del. **T-12-1762**



Trade Literature

For Free Booklets and Catalogs—Convenient Request Card on Page 171

Epoxy Resins

Bulletins EP-54-10a and EP-55-61 present results of detailed information on Epocast epoxy resins 4-B and 4-B-2 and on 4-C and 4-D respectively; cover physical and chemical properties, applications, and their characteristics in use. Furane Plastics, Inc., 4516 Brazil St., Los Angeles 39, Calif. **L-12-1**

Gages

Illustrated brochure shows and describes company's line of snap, bore, large diameter and length gages and companion setmasters which are adjustable for all dimensions; includes specification and price lists plus providing simplified method of presenting specific gaging problems to manufacturer for solution. Boice Mfg. Co., Staatsburg, N. Y. **L-12-2**

Can Machinery

Complete line of flanging, beading and thread rolling machinery for medium and high speed can making lines described in 20-page illustrated brochure; design and construction features of all equipment are described and their dimensions and specifications listed. E. W. Bliss Co., 50 Church St., New York 7, N. Y. **L-12-3**

Tap Holders, Drivers

Illustrated Bulletin 4-50 discusses details of redesigned line of tap holders and drivers; includes specification and application information. Scully-Jones and Co., 1901 S. Rockwell St., Chicago 8, Ill. **L-12-4**

Press Brakes

Two new press brakes, the 2-30 and 3-50 series, which have been added to company's line, are presented in 4-page illustrated folder stressing design features and advantages. The Cincinnati Shaper Co., Cincinnati 25, Ohio. **L-12-5**

Surface Grinders

Company's No. 72 and 100 high-production rotary automatic surface grinders for machining flat surfaces on long run jobs in continuous, single pass operations presented in Bulletin No. 147-2; describes various models, their advantages, special features and applications. Mattison Machine Works, 545 Blackhawk Park Ave., Rockford, Ill. **L-12-6**

Titanium

Handy pocket folder, "Facts About Titanium," contains list of commonly available titanium alloys, their compositions, forming and welding methods, heat treatment and machining information, and comparison of titanium properties with those of a stainless steel and aluminum alloy. Arthur D. Little, Inc., Mechanical Engineering Div., 30 Memorial Dr., Cambridge 42, Mass. **L-12-7**

Process, Transfer Equipment

Sixteen-page booklet describes special automatic process and transfer equipment emphasizing economy and other advantages; illustrated with photos, drawings and diagrams; features diagram of a cylinder block production line as typical example of production line engineering showing how equipment is utilized. W. F. & John Barnes Co., Process Equipment Div., 369 S. Water St., Rockford, Ill. **L-12-8**

No need to hold back any longer . . .

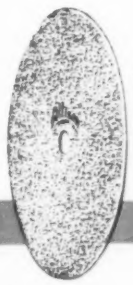
Adequate Titanium Supply Assured by Aircraft Production Resources Agency

January, 1954, Bulletin:

"It is evident that there will be more assurance of an adequate supply to meet most planned production programs in 1954."

Titanium IS RARIN' TO GO!

. . . and the cutting of Titanium is no longer a problem, either. Allison abrasive cutting wheels can speed your company on its way to finding new uses for this wonder metal. Tests prove that abrasive cutting is *the only efficient and economical method* for cutting Titanium, as well as many of the tough "new" high-temperature-resistant alloys.



The cutting of Titanium with Allison abrasive wheels is comparable in speed, quality and economy with that of cutting most grades of steel.

Tough Cut-Off Jobs Are Easy . . . with Allison.

YOURS, TOO, CAN BE ROUTINE.

The *best* way to cut many materials . . . the *only* way to cut some.

Allison ABRASIVE CUTTING WHEELS

THE ALLISON CO., 254 ISLAND BROOK AVENUE, BRIDGEPORT 8, CONN.

2AL54B

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Inserts

Booklet, Form B-300, describes Kendex tooling, featuring 17 throw-away insert styles; illustrates how this tooling saves time, cuts costs and improves process. Kennametal, Inc., Latrobe, Pa. **L-12-9**

Specialty Steels

Thirty-two page illustrated guide to specialty steels defines special characteristics of broad range of special purpose steels in terms of end use; also gives information on quality controls necessary in the manufacture of these steels; offers aid to selecting proper steel for specific job to improve tooling, fabrication and product performance. The Carpenter Steel Co., 354 W. Bern St., Reading, Pa. **L-12-10**

Valves

Three bulletins cover Shear-Seal valves according to their major service conditions: A-5 deals with manually and foot operated air valves, 0 to 4000 psi; W-5 covers manual water valves, 0 to 600 psi; and 0-5 covers manual oil valves, 0 to 6000 psi. All include valve characteristics, flow patterns, overall dimensions, photographs and ordering data. Barksdale Valves, 5125 Alcoa Ave., Los Angeles 58, Calif. **L-12-11**

Presses

Illustrated 4-page condensed catalog includes descriptions and specification tables for company's Rousselle punch, OBI inclinable and horn presses. Service Machine Co., 2310 W. 78th St., Chicago 4, Ill. **L-12-12**

Steel Fabrication

Fabricators' Handbook provides up-to-date information on forming, machining, cutting, joining, heat treating and pickling, and finishing stainless steel, plus complete section of reference data including compositions, characteristics, tolerance, gage and weight charts, conversion tables, etc.; well illustrated with photos, drawings and graphs. Request only on company letterhead direct from Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.

Jig Borers

Line of Electrolimit jig borers presented in extensively illustrated, 28-page brochure discusing operation, showing construction, special features and advantages of units, outlining their specifications and suggesting appropriate applications. Pratt & Whitney Co., Inc., West Hartford 1, Conn. **L-12-13**

Boron

Sixteen-page "Handbook on Boron Carbide and Elemental Boron" provides technical information on materials made by the company for use in atomic energy field. Norton Co., Worcester 6, Mass. **L-12-14**

Centerless Grinders

Company's No. 12 and No. 12½ precision centerless grinders covered in 26-page catalog which includes 56 photos and sketches showing construction, special features, operation details; includes specifications and discussion of standard and extra equipment; also describes variety of applications and automation ideas for centerless grinders. Landis Tool Co., Waynesboro, Pa. **L-12-15**

Punch Presses

Twenty-page catalog, "Profit from Presses," illustrates case histories of punch press applications in 34 different manufacturing plants; action photos illustrate the discussions of the various operations. Diamond Machine Tool Co., Pico, Calif. **L-12-16**

Aluminum

Illustrated 52-page booklet presents technical data and tooling information on "Machining Kaiser Aluminum with Automatic Screw Machines"; tables cover speeds and feeds for cutting, skiving, cutoff, drilling, reaming, boring, counterboring and trepannig, recessing, box tools and hollow mills, threading, thread rolling, cross slide knurling and turret knurling; drawings and photos show proper tool angles for machining various alloys suitable for screw machines. Technical Editor, Kaiser Aluminum & Chemical Sales, Inc., 228 N. LaSalle St., Chicago 1, Ill. **L-12-17**

Efficiency in Cutting-off is Important

Practically all machining operations start with pieces cut-off from bars or billets. Hence, inefficiency, or lack of capacity, in the cut-off department can hold up or stagnate the entire plant.

A. Are all-ball-bearing and provide a quick return; therefore they run FASTER than others on the same work.

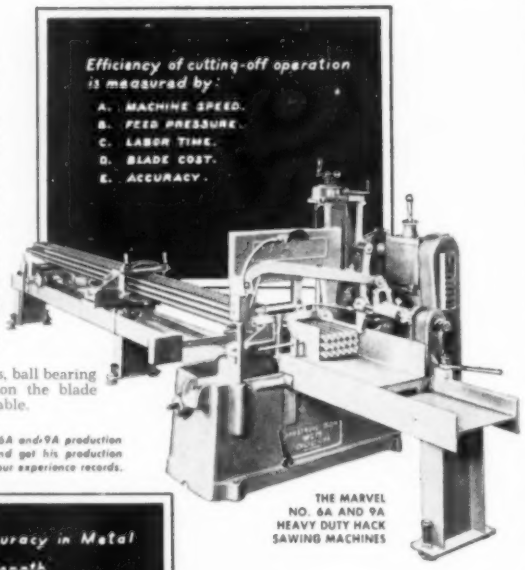
B. Can apply as much as 1200 pounds feed pressure—two to ten times as much as other hack saws and band saws.

C. Are fully automatic, requiring no more operator attention than an automatic screw machine; and set-up for any bar size and cut-off length is extremely simple.

D. Use a non-breakable high speed hack-saw blade—the type of saw blade that produces the greatest number of square inches of metal cut per dollar of blade cost—two to ten times (or more) as much as any band saw.

E. Because of their exceptional sturdiness, ball bearing reciprocating frame, ability to tension the blade "truly taut", their accuracy is dependable.

If you are not using modern, improved MARVEL NO. 6A and 9A production hack saws, call the local MARVEL Field Engineer and get his production and cost estimates on your work—to compare with your experience records.



THE MARVEL NO. 6A AND 9A HEAVY DUTY HACK SAWING MACHINES

Formula for Accuracy in Metal Sawing:

$$\text{ACCURACY} = \begin{pmatrix}\text{Length}\\ \text{Straightness}\\ \text{Squareness}\end{pmatrix}$$

$$\begin{pmatrix}\text{Straightness}\\ \text{Squareness}\end{pmatrix} = \begin{pmatrix}\text{Blade Rigidity}\\ \text{Blade Toutness}\end{pmatrix}$$

The composite MARVEL High-Speed-Edge Hack Saw Blade—cuts **any** machinable material efficiently. There is no time lost changing blades for different types of steel; no time lost replacing shattered blades, because MARVEL High-Speed-Edge Hack Saw Blades are positively **unbreakable.** These superior blades have the finest high speed steel cutting edge welded to a strong alloy steel body. They will stand-up under the highest speeds and heaviest feeds attainable on any make hack saw. Can be safely tensioned tauter than any other blade—cut-off not only straight but also square and with less stock loss.

Write for catalog C-55—showing and describing eleven different series of Metal Cutting Sawing Machines and MARVEL High-Speed-Edge Hack Saw Blades and Hole Saws.

MARVEL Metal Cutting SAWS — Better Machines—Better Blades

ARMSTRONG-BLUM MFG. CO. 5700 West Bloomingdale Avenue • Chicago 39, U.S.A.

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ternal Grinding

Three folders describe and illustrate pany's special equipment for in- nal grinding. First covers Series 800 gh frequency wheelheads, including mplete technical data on the wheel- ads plus information on alternators nd high-frequency motors. Second escribes automatic sizing, illustrating ryant air, solid plug and diamond siz- ng with schematics. Third deals with ew process controller which provides tatistical quality control for accurate niform production. Bryant Chucking Grinder Co., Springfield, Vt. **L-12-18**

Marking Tools

"Marking Tools and Marking Equip- ment" covers range of tools from hard stamps to automatic marking machines, the products on which they are used, and various fixture setups for marking operations. Geo T. Schmidt, Inc., 4100 Ravenswood Ave., Chicago 13, Ill. **L-12-19**

Pneumatic Tools, Equipment

Illustrated catalog presents details of line of pneumatic tools and equipment including automatic air line filters, air presure regulating valves, automatic air line lubricators and pneumatic grind- ers; describes construction, main fea- tures, specifications and prices. M-B Products 46 Victor Ave., Detroit 3, Mich. **L-12-20**

Diamond Wheels

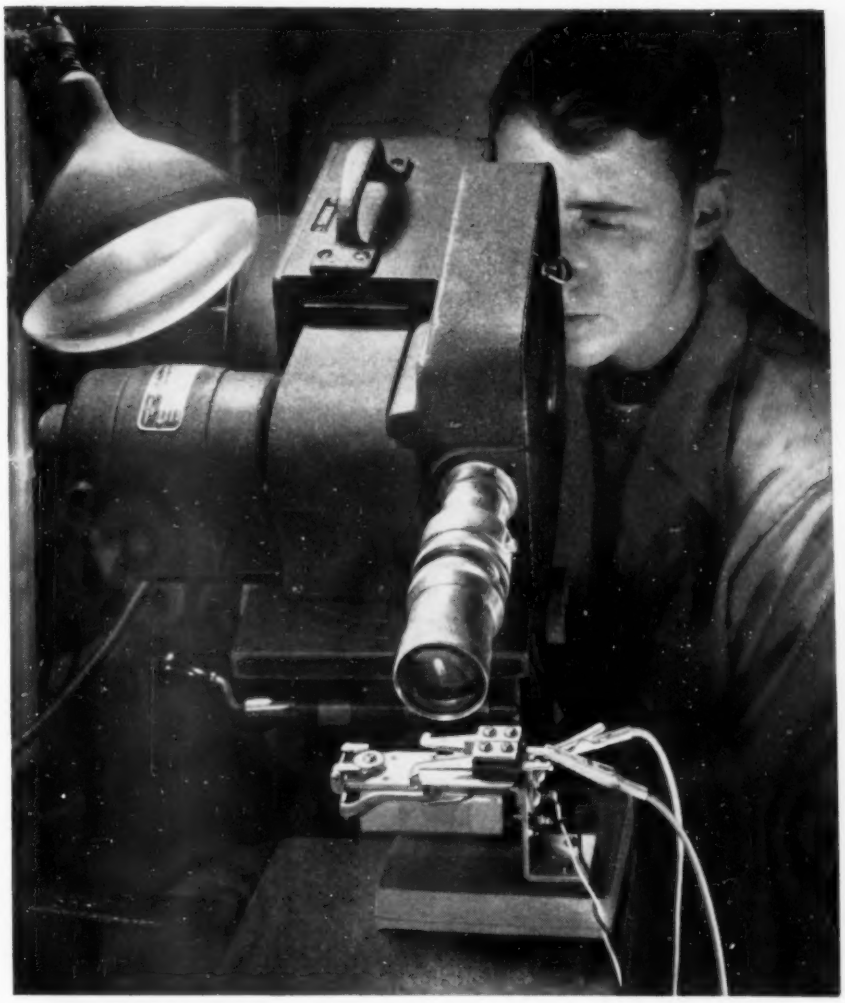
Twenty-four page catalog gives specifications and prices for line of resinoid bond diamond wheels; drawings show wheel details. Daniel S. de Rimini, Inc., 550 Fifth Ave., New York 36, N. Y. **L-12-21**

Materials Handling Equipment

Condensed 50-page Catalog No. 5510 presents technical data plus brief descriptions and illustrations of vibratory equipment, feeders, conveyors, power tools, shaft seals, selenium rectifiers, electric hammers and other materials handling equipment. Syntron Co., 340 Lexington Ave., Homer City, Pa. **L-12-22**

Band Saws

Descriptive data and specifications for complete line of metal cutting band saws in capacities from 3½ by 6 in. to 12 by 16 in. presented in illustrated 8-page catalog; includes information on automatic bar feed equipment, stock stands and accessories; also provides handy blade and speed selection chart for cutting various materials. Wells Mfg. Corp., 600 Service Rd., Three Rivers, Mich. **L-12-23**



Eye

Each year more and more companies use super-slow-motion movies (up to 3200 pictures a second) to solve design, production, and maintenance problems involving motion too fast for the human eye to follow. Some even use such movies as a sales tool.

Kodak has just introduced a new film for this work, far more sensitive than any hitherto available. It is already contributing heavily to the achievements of specialists in the use of high speed movie cameras.

But there is one high speed camera on the market so simple that a man can use it successfully without taking time out to become a specialist. It is called, simply, the Kodak High Speed Camera. For full details about it, write *Graphic Reproduction Division...*

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

the Kodak *HIGH SPEED* Camera

Kodak

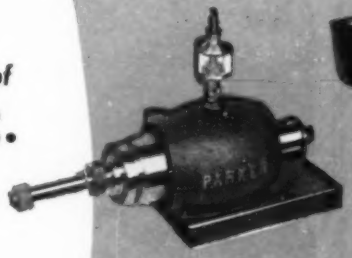
FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A-12-179

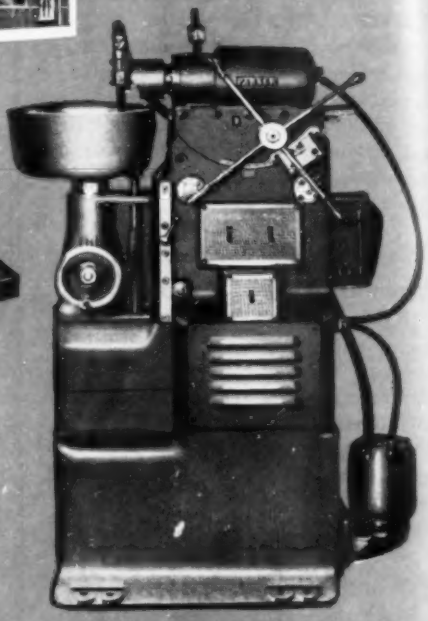
PARKER • MAJESTIC PM PRECISION MACHINES

Pictured here is the home and products of

PARKER-MAJESTIC, INC.

ESTABLISHED 1929

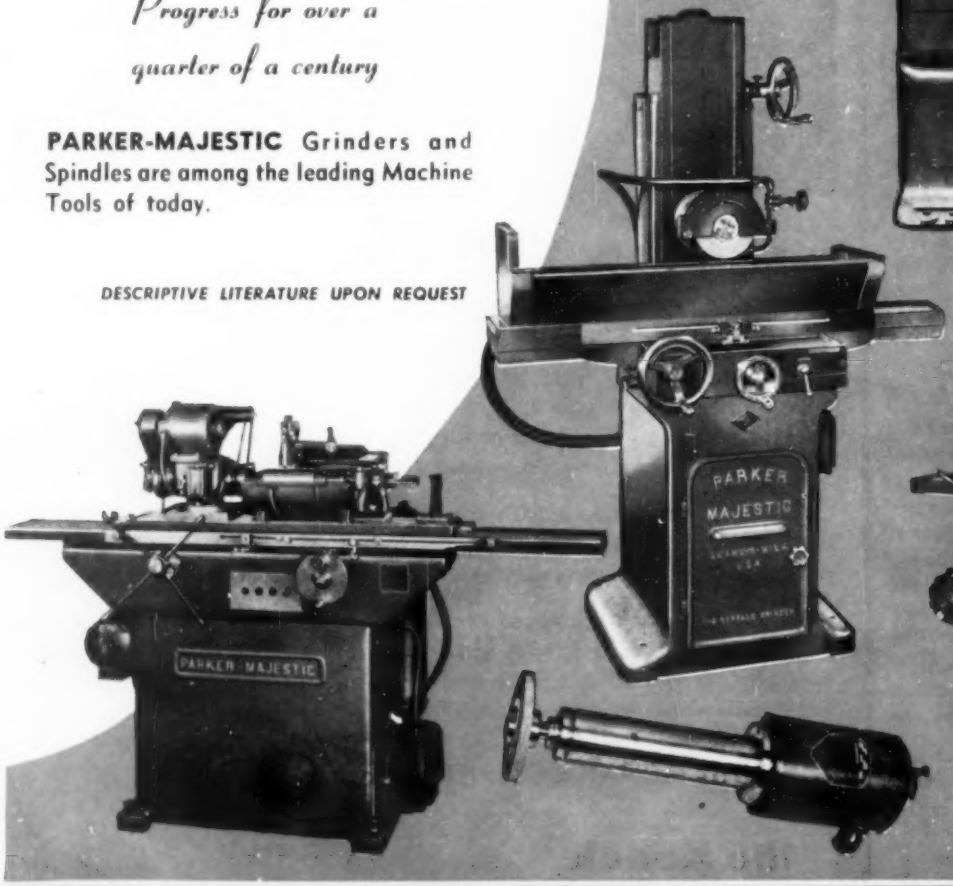


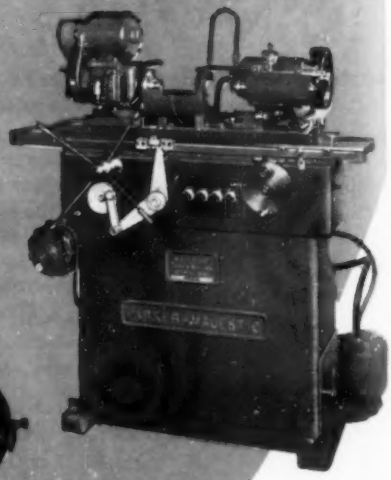


Progress for over a quarter of a century

PARKER-MAJESTIC Grinders and Spindles are among the leading Machine Tools of today.

DESCRIPTIVE LITERATURE UPON REQUEST





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Field Notes...

The Army Ordnance Corps has appealed for cooperation of the tool and metalworking fields in its preparation of a comprehensive Ordnance Engineering Design Handbook. The book, which will summarize fundamental principles and basic design data, is planned to consist of approximately 180 sections of about 100 pages each.

The request made to industry is for use of either formal or informal collections of terminologies, glossaries, specialized dictionaries or references to such collections.

Because ordnance engineering cuts across so many fields of science and technology, information for design work must be drawn from multiple diverse fields of knowledge. Persons, organizations or companies which have information useful to the compilation of the manual have been invited by the Corps to contact Allen Kent, Assoc. Director, Center for Documentation and Communication Research, School of Library Science, Western Reserve University, Cleveland 6, Ohio.

Completion of the first edition of the handbook is expected to require about five years.

v v v

An annual competition is being sponsored by Allmetal Screw Products Co., Inc., as a stimulus to bring to industry more information about stainless steel. An award of $1000 will be given to the author of the article of most value and interest to those who specify or buy stainless steel parts or components. Judging of the articles submitted for competition will be done by a panel of four experts representing the steel industry: Ray G. Sloan, of Armco Steel Corp.; F. Price Norris, Jr., of Allegheny Ludlum Steel Corp.; Richard E. Paret, representing the American Iron and Steel Institute; and James D. Glenn of Crucible Steel Co. of America. Winners of this first annual award will be announced by the company February 15, 1956.

Details are available from the secretary of the Allmetal Award Committee at the company's office in Garden City, N. Y.

expansions

A $2-million expansion program for the Scintilla division of Bendix Aviation Corp. will be completed by the end of this year. New facilities now under construction cover 25,000 sq ft and will be devoted to manufacturing, and research on many types of electrical equipment. Engineering, design, research and laboratory and experimental machining facilities will be consolidated in another, slightly smaller, new building. The divisional program is part of the $10-million expansion of corporation engineering facilities announced earlier.

v v v

An addition which will join to the St. Charles Rd. plant of Shakeproof Div. of Illinois Tool Works is under construction. When completed, probably in April, 1956, the Shakeproof Div., including engineering, manufacturing and sales of standard parts, will be consolidated in the new plant. Certain operations and personnel will be moved into the new area from the company's plants at Des Plaines and Elgin to allow growth of present activities as well as growth of new activities at those facilities.

v v v

A $90-million expansion program involving five of its principal manufacturing plants is now underway for Kaiser Aluminum & Chemical Corp. The plant at Ravenswood, W. Va., will be the major target because of an additional $75-million which is being spent to enlarge and complete the initial facilities now under construction as a fully integrated sheet and foil rolling mill. Completion there is expected by early 1957; more than a year earlier than the original date set. The Ravenswood works will have an annual capacity of 333.5-million lb of commercial sheet and foil products as compared with the 250-million-lb capacity originally planned.

v v v

Experimental facilities at its Speedway Laboratories are being expanded by Linde Air Products Co., Div. of Union Carbide and Carbon Corp. Work, which involves conversion of a former factory building into a modern laboratory and office facility, is scheduled for completion by next spring. Cost of construction and equipment will amount to approximately $1½-million.

v v v

A $300,000 expansion of facilities is under way for Barry Controls Inc. to permit addition of new production processes to the company's current operations. When completed, a new building providing 24,000 sq ft of floor space for administrative, accounting, sales and production control offices in addition to enlarged production facilities, will cost approximately $250,000. The remaining $50,000 is to be used to renovate the present Barry building. Engineering activities are to be expanded and will utilize the office area now housed in the old building.

v v v

Wesson Co. is expanding its Canadian operations with the opening of a new division, Wesson Cutting Tools, Ltd., at 93 Leicester Ave., Toronto. Initially, manufacturing operations will consist of standard and special single point tool fabrication. This is the third major expansion for Wesson within the past 12 months.

v v v

A 35 percent increase in floor space has been gained by Gear Grinding Machine Co. with the completion of a new plant addition. Cost for completely equipping the new addition for production of the company's new single spindle automatic screw machine is expected to exceed $500,000.

v v v

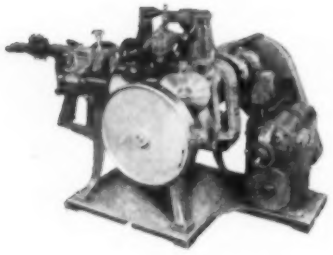
Completion of the new $300,000 plant of the Etna Machine Co. is scheduled for early December. The building, located near Perrysburg, Ohio, will provide 40,000 sq ft of floor space. Besides enlarging manufacturing area, the plant also will provide quarters for the Abbey Etna Co., sales representatives for Etna.

acquisitions

Hufford Machine Works Inc., including all three of its divisions, has been purchased from J. A. Helget by a group of men organized by William Husted of New York City. Mr. Helget, president and general manager of the company which he organized in 1942, has retired. All former officers remain with the company. New president of the firm is M. L. Bengtson who has headed the Bengtson Inc., a firm he organized to engage in design of special machinery. Mr. Bengtson is a member of ASTE's Chicago chapter.

v v v

Ownership of Murray Engineering Co. has been transfered to Joseph J. Grum, now president, and Kenneth C. Martens, now secretary and treasurer, of Engineering Service Inc. of America. Announcement of the change was made by Murray's board of directors. Mr. Grum, formerly chief engineer, and Mr.



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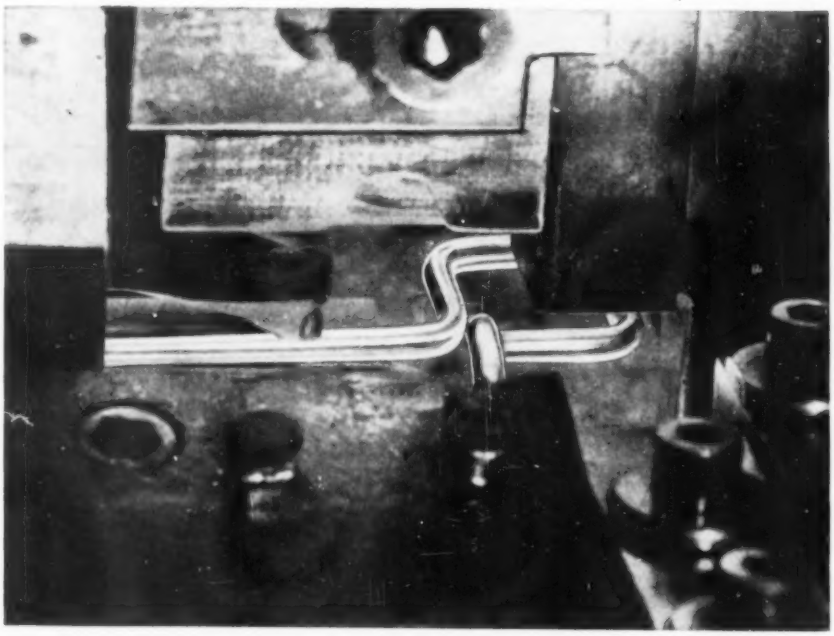

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Martens, formerly chief die engineer of Pioneer Engineering & Mfg. Co., acquired ownership coincident with the transfer of stock from Harry L. Murray, the company's founder and president. According to the new owners, the entire present staff, including Mr. Murray, will remain with the organization. Operations are to be merged into and continued under the original name of Engineering Service Inc. of America. Both Mr. Grum and Mr. Martens are members of ASTE's Detroit chapter.

v v v

The business of manufacturing and merchandising the Rawson coupling has been acquired by O. S. Walker Co., Inc. For a number of years the coupling has been made and sold by the Washburn Shops at Worcester Polytechnic Institute. Personnel and manufacturing resources are being installed in Walker's Rockdale St. plant. The newly acquired business is to be carried on as The Rawson Coupling Div. of the Walker Co.

v v v

The Thredco Co. in Berkley, Mich., is now being operated as the Midwestern division of Nilsson Gage Co., Inc. The Berkley plant will add plain plug and ring gages to its current line of thread gages for faster and more complete service according to the announcement.

new activities

Body engineering will be the exclusive interest of the division recently formed by Pioneer Engineering & Mfg. Co., Inc. It will be located in Pioneer's Goldner Div., and will provide complete body engineering services from artists' renderings to production drafts and details. It also will contract and supervise construction of scale and full size models.

v v v

Portomag Sales, Inc. has been formed to handle both national and foreign sales and service of Portomag units manufactured by Lupear's Tool and Die Co. Headquarters for the new sales firm is at 1511 E. Nine Mile Rd., Ferndale 20, Mich.

v v v

A short run service, producing prototype models and short run machined metal parts and stampings has been instituted by Technion Design & Mfg. Co., Inc., 262 Mott St., New York, N. Y. The new department is an integrated unit, operating separately from the company's production contract manu-

cturing and heat resistant fixture epartments. It was set up to allow esearch groups, laboratories and exerimental engineering departments to ake advantage of a rapid and low cost ethod of procuring precision metal omponents and assemblies in all etals, including titanium, molybdenum nd magnesium to tolerances as close s ±0.0001 in.

v v v

Plans for expansion and diversification of production have been announced by The Gruen Watch Co. with the establishment of Gruen Precision Laboratories, Inc. for the engineering, development and production of precision products for consumer, industrial and defense use. The new company, a wholly owned subsidiary of Gruen Watch, will be located in Cincinnati. Edward H. Weitzen, chief executive of the parent company, will be president of Gruen Laboratory.

moves

Detroit Reamer & Tool Co. has moved into its new plant and offices at 780 W. Maple Rd., Birmingham, Mich. The new factory is designed to nearly double the company's present production area.

v v v

Transfer of its general offices to Kalamazoo, Mich., has been completed by Ruud Mfg. Co. An openhouse marked the occasion as the company formally established itself as a complete major industry in that city. For more than 60 years, Ruud's general offices have been located in Pittsburgh.

v v v

The West Coast Div. of H & B American Machine Co., Inc. has doubled its capacity to produce structural parts for military aircraft through its move to the new building at 10117-21 Jefferson Blvd., Culver City, Calif.

sales

A new eastern Burgmaster sales division has been set up by Burg Tool Mfg. Co. at 15 W. 44th St., New York, N. Y. Bill McAvay, formerly eastern division sales manager for the DoAll Co., has been named to head the new setup, which will serve Greater New York area, New Jersey and adjacent territory as facilities permit.

v v v

Jones & Laughlin Steel Corp.'s warehouse customers in the Detroit area are scheduled to receive faster service

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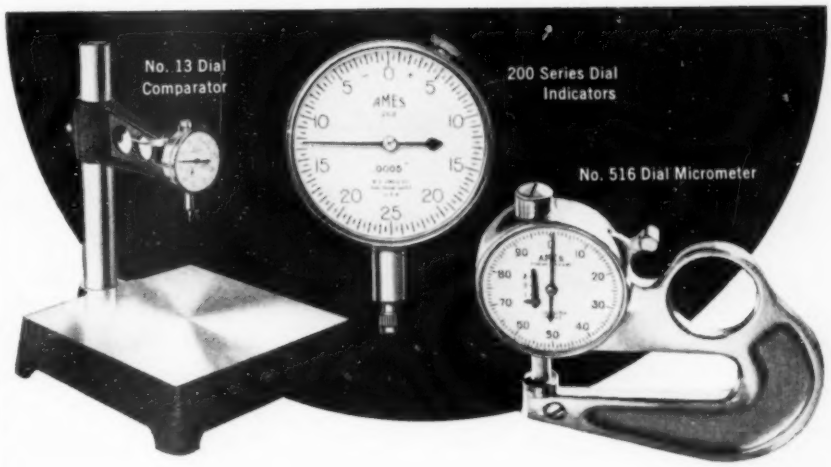

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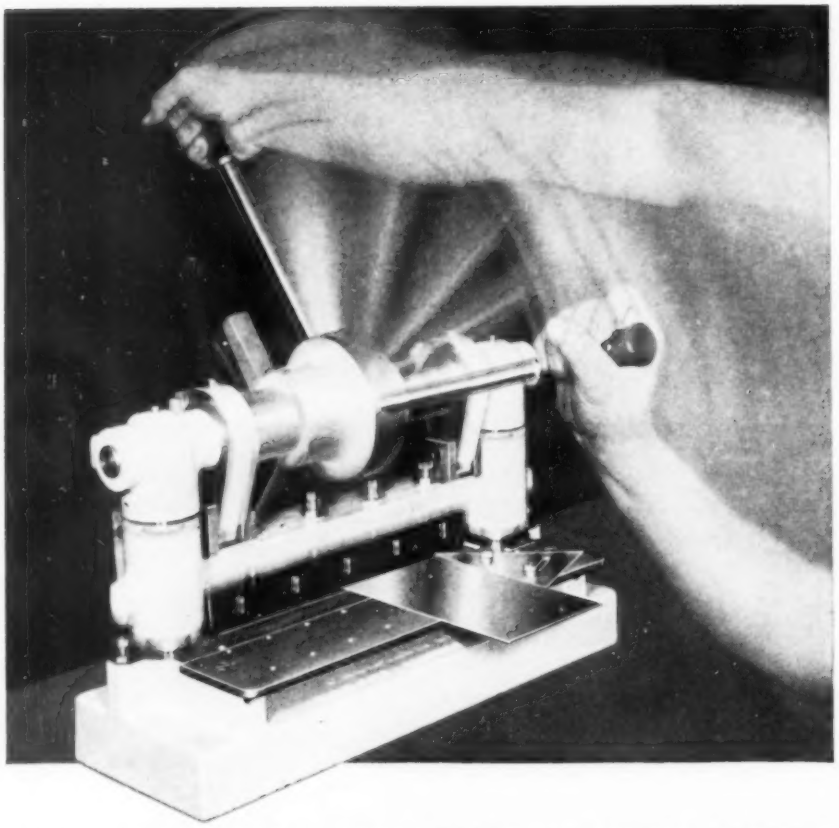

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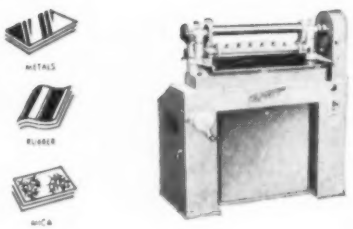

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because of the company's acquisition of a new warehouse building at 1231 Hubbell Ave., Detroit. General steel products such as structurals, plates, bars, strip and sheet, stainless steels and wire rope will be available from this new stock source. L. S. Roehm has been named warehouse manager.

v v v

Progressive Welder Sales Co., has now completed arrangements for offering their complete line of equipment, including standard or special designed units, on a lease basis. According to J. F. McRoberts, vice-president and general manager of the company, preliminary survey of the market has indicated a popular demand for this type of equipment leasing plan which already has proved successful in other fields.

v v v

Right as sole agency for the sale in the United States of Canavese line of lathes has been granted Misal Machinery Inc. by the manufacturer Eredi G. Canavese of Crema.

v v v

A new tool steel warehouse has been opened in Detroit by A. Milne & Co. The warehouse, located at 4820 Wabash Ave., is under the managership of W. Ted Nagorsen.

sales personnel

The Lapointe Machine Tool Co. has announced the appointment of Paul N. Stanton to fill the post of assistant sales manager of the company. For several years, he has been manager of sales and programming at Cambridge Corp. a subsidiary of Carrier Corp.

v v v

A. C. Erhardt, Jr. has been made director of sales for National Tool Co. He succeeds Joseph B. Clough who left National to establish his own concern, The Joseph B. Clough Co., manufacturers' representatives.

v v v

According to announcement made by Hy-Pro Tool Co., Francis T. Thorley has been made assistant sales manager of the company. At the same time, the company revealed appointment of Mad River Supply Co., 42-46 W. High St., Springfield, Ohio, as a Hy-Pro stocking distributor.

v v v

Kenneth W. McKenzie has been named sales manager of Industrial Tectonics, Inc. He is a member of ASTE's Ann Arbor Area chapter.

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For **PROFIT PRODUCTION** and **LONG, NON-STOP** runs... Willey's Tungsten Carbide Tools best meet the demands of Modern Automation.

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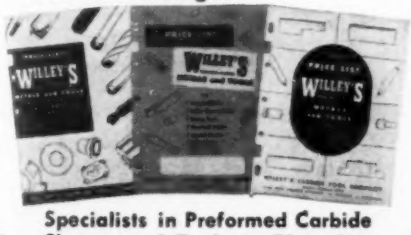

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abstracts of FOREIGN LITERATURE

By M. Kronenberg
Consulting Engineer

Variable Speed Drive

A mathematical analysis of the rolling action of balls used in a variable speed drive is presented in an article published by O. Lutz in the September issue of *Konstruktion*. The drive has a range from 3:1 to 1:3 and depends on the friction of balls, with no gears or hydraulic devices employed.

The author goes into the complex mathematical conditions affecting the efficiency of the drive and reports on tests which were run to supplement the theoretical findings. Among the conclusions which will help in further development of this type of infinitely variable speed transmission the author mentions that line contacts should be avoided and that several points of contact are more efficient than a few. Efficiency is better for materials with a high modulus of elasticity.

Progress in Jig Borer Design

Preselector devices and programming methods are among the many improvements that have taken place in the past few years in the design of jig borers in Europe, according to K. Haeuser, writing in the August issue of *Werkstatt und Betrieb*.

Other progress made in this field of manufacturing and machine tool design relates to improvements of setting accuracy; simplification of operation and handling; improvements in the readability of the scales used for coordinate setting, resulting in increased accuracy of as much as 0.000040 inch (forty microinches). The author goes on to describe jig borers made by Burkhardt, Lindner, Hermann Kolb, L. Schwarzkopf, Abawerke, Meyer & Schmidt, Gebr. Perrin, Isoma, Oerlikon, Societe Genevoise de Physique and Coventry Tool Co., thus covering German, Swiss, French, and British machines.

In the Burkhardt machine the spindle is driven by a Leonard aggregate with infinitely variable speeds between 5 and 1500 rpm without the use of gears or clutches. Starting and stop-

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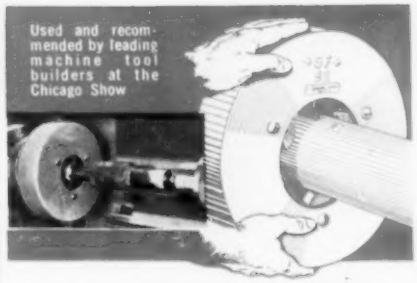

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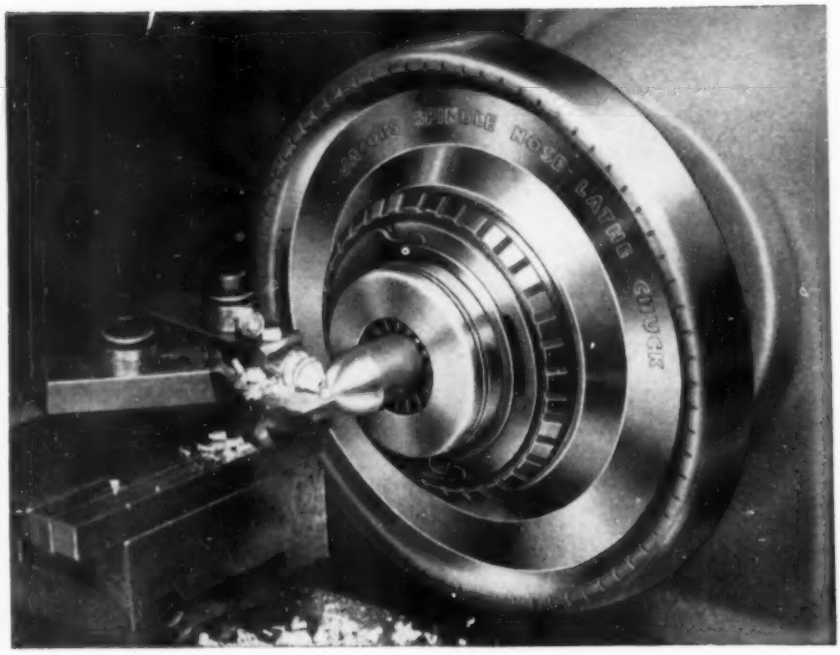

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Capacity. Model 91 chucks any bar between 1/16″ and 1-3/8″. 11 Rubber-Flex collets cover the gripping range of as many as 88 steel collets formerly needed.

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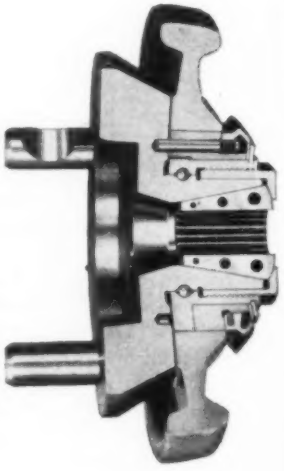

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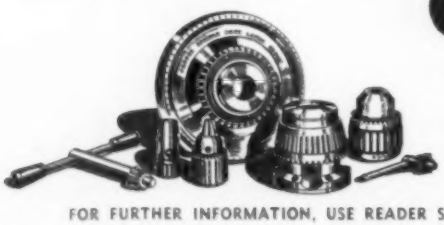

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ping is by push-button control. The former optical control has been replaced by a combined optical-electrical device. Graduations on the scale are projected onto a screen and can be read between two limit values. Zero position is indicated automatically at the instant the graduation is exactly on center.

In the case of the Schwartzkopf machine accuracy is 400 microinches and has remained unchanged in order to maintain speed of machining and setting. The machine, however, is equipped with a programming device that permits integrating four programming points, longitudinally and crosswise.

The Oerlikon jig borer is built similar to a radial drill with a supporting bracket at the outer end of the arm, while the French machine by Perrin is built so that the operator can control it when sitting on a chair, eliminating fatigue which might affect the accuracy of the work.

Welding Congress

A welding congress was held at Frankfurt A. M., West Germany. Erich Sudach has prepared a report of it for the August issue 1955 of *Werkstatt und Betrieb*.

Sixteen papers were presented, mostly by European engineers, although the United States was represented by H. R. Pufahl, New York, who discussed the question of gas-shielded welding methods. Kellermann & Lehrmann presented a paper on "Fumes and Smoke in Welding"; Kauhausen devoted some time to the problem of welding of heat resistant steels, while W. Lenk's paper dealt with "Material and Oxygene Cutting."

A related topic was considered by R. Bechtle, namely, form cutting of mass production articles.

Swiss Report on Russian Machine Tools

About 2½ million people are supposedly employed in the Russian machine tool industry according to an article in Issue No. 8 of *Industrielle Organisation* published by the Swiss Institute of Technology (Eidgenoessische Technische Hochschule) at Zurich. Comparing this figure with our own employment in the machine tool industry in the United States—which is a small fraction—may indicate the reason the large number of engineers required in Russia.

They build lathes up to 80-inch swing, vertical boring machines up to 470 tons weight and 500-inch table diameter, horizontal boring mills up to 330 tons weight and 480-inch table length. The author, H. Pfitzer, also indicates that considerable research is being carried out in the field of ceramic cutting tools, using about 2000-fpm cutting speed with a tool life of about 150

utes, cutting steel. The cutting temperature is low with these tools and the surface finish very good.

New grinding wheels have been developed, permitting a wheel speed of 1400 fpm, an increase in tool life of about 50 percent and an improvement in surface finish of 35 to 70 percent. High cutting speeds are in great favor in Russia according to the author, where 1100 new designs of machine tools have been developed in 1951 and 1952. Lathes give cutting speeds of 6000 fpm on steel and 30,000 fpm on aluminum.

German Reports on Russian Tools and Metal-Cutting

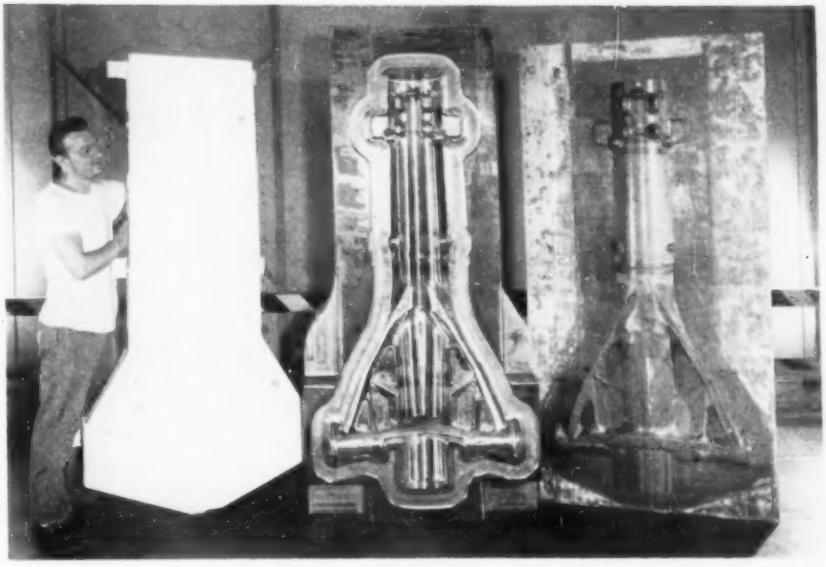
A considerable number of Russian books and articles on machine tools and metal-cutting investigations has been translated and published in German in *Neuerscheinungen Wissenschaftlicher Literatur*. An article on electro-spark processes was published by L. M. Bityukov and V. M. Korshenko in Issue No. 4, 1955 of the magazine. A book of 177 pages on electro-spark cutting was published by N. Kiado and is mentioned in the same issue. Present and future prospects in the development of electro-erosive machining methods, authored by L. Liwschitz and W. Rassochin are discussed in Issue No. 7, Vol. 5, 1955 of *Fertigungstechnik* (July issue). Also in Issue No. 4 of *Neuerscheinungen*, 1955 another article on electro-sparking is published with a description by G. P. Ivanov of a new machine with current densities of spark discharges from 3 to 120 amps when 5 electrodes are used. Investigations show that a surface similar to a nitrided surface can be obtained by electro-sparking.

Russian Papers on Machining Processes

The strength of metal-ceramic alloys of tungsten carbide in relation to temperature and grain size is the title of a paper by G. S. Kreimer, O. S. Safanova and A. I. Baranov, as indicated in the *Translated Contents List of Russian Periodicals* published in London, England. Another paper, published by V. Sokolovsky deals with equations of the theory on plasticity.

The relationship between friction and surface finish when cutting metals in different media was the topic of a paper by Y. M. Vinogradov as indicated in *Translated Contents*, Issue No. 76, 1955, page 42. In the same issue an article by N. F. Kazakov deals with the influence of the tool hardness on metal-cutting by the electric spark method. The author discusses also, in the same issue, effect of high-speed machining on metal-cutting theory.

HYSOL Tooling Materials For Large Keller Patterns . .



Left above is the Keller pattern constructed of HYSOL tooling materials from mahogany wood pattern at right. Center is steel forge die Kellered from the plastic pattern. The Keller pattern was constructed by laminating glass cloth with HYSOL liquid tooling resin to

provide these OUTSTANDING ADVANTAGES . . .

Light Weight Patterns	Exact Reproduction of Wood Pattern
Excellent Surface for Stylus	Stability — No Special Storage
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Fixtures for inspection	Keller Patterns	Lathe Fixtures
Drilling	Draw Dies	Milling Fixtures
Locating	Hydropress Dies	Buffing Chucks
Trimming	Paint Masks	Core Box
Layout	Prototype Parts	Core Box Sections
Spotting Blocks	Spinning Chucks	Core Driers
Vacuum Forms	Holding Fixtures	Pattern Parts

Assembly Fixtures: welding—spot welding, arc welding, gas welding.
Molds for casting other materials.

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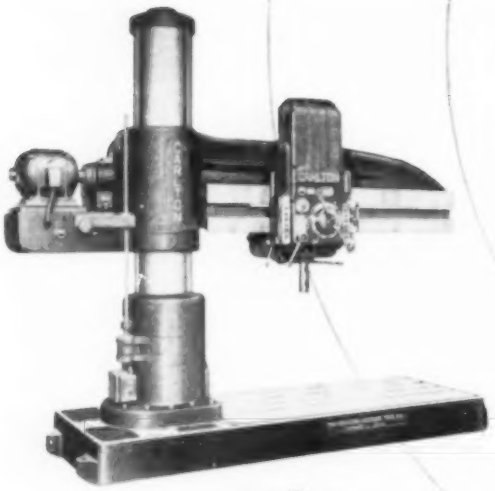

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Men at Work

Precision Castings Co., Inc. has announced election of new officers and directors. **E. H. Heckett** is chairman of the board and a director; **William J. During,** president and director; **J. J. Punke,** senior vice-president and director; and **A. G. Lintel** and **Ross W. Castle** are both vice-presidents and directors. Three other new vice-presidents are **A. D. Weigolt, E. A. Dunning** and **Stanley Frost** who head the Cleveland, Cortland and Kalamazoo plants respectively. **A. G. Chase** is honorary chairman while other directors include **J. T. Simpson, D. M. Horner** and **William J. During, Jr.** who also is secretary.

Precision Castings was acquired as a subsidiary of The Harrisburg Steel Corp. last summer. Messers. Heckett, Simpson and Horner also are officers and directors of the Harrisburg firm. Mr. Chase was formerly board chairman, and Mr. During was president of Precision.

Chauncey G. Newton now heads a new sales engineering organization known as Anderson-Newton Co. His associate is **Harold A. Anderson** who formerly represented Pratt & Whitney in Eastern New York state. Mr. Newton, a member of ASTE's Rochester chapter, recently resigned from Pratt & Whitney after 27 years as district manager of that company's Rochester office.

Left. **J. J. Jaeger, chief engineer of the Machine Tool Div. of Pratt & Whitney Co., Inc., is now vice-president and chief engineer of the division.**

Right. **Albert L. Knapp, new vice-president and manager of P & W's Machine Tool Div., was division general superintendent. He belongs to ASTE's Hartford Chapter.**

Edward J. Ferris has been named general superintendent of the Machine Tool Div. of Pratt & Whitney Co., Inc. Mr. Ferris, a veteran of 32 years with the company, was previously assistant general superintendent of the division.

John E. Mott is new general service manager for both the Automotive and the Machine Tool Divs. of Van Norman Co. A veteran of 20 years with Van Norman, Mr. Mott formerly was superintendent in charge of assembly at the Automotive Div.

Minneapolis-Honeywell Regulator Co. has revealed appointment of **C. L. Peterson** to the office of vice-president and general manager of its Brown Instrument Div. Mr. Peterson was formerly a divisional vice-president.

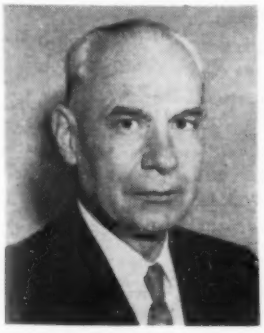
D. M. Hallier has been named manager of cutting tools for The Motch & Merryweather Machinery Co. where he will direct the operations of both the cutting tool distributor and the cutting tool manufacturing divisions. He has been manager of the latter division since 1949. Mr. Hallier is a member of ASTE's Cleveland chapter.

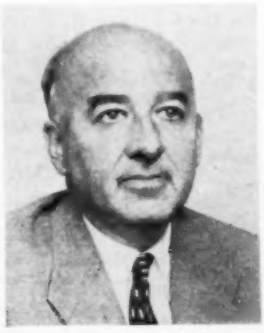
McReynolds Die & Tool Co. has announced the retirement of **Kenneth B. Spaulding** as vice-president and director of the company. Mr. Spaulding is a member of ASTE's Detroit chapter. At the same time, announcement was made of the election of **George A. Dakoske** as vice-president and assistant general manager.

Alco Products, Inc. has made public the appointment of **William L. Clark** as product manager of the company's Alcoplate process. In this capacity, he will be in charge of all phases of production, marketing and research involved in this method of chemical nickel plating.

Appointment of **Joseph E. Mihm** as assistant vice-president has been announced by Walworth Co. He will be in charge of the company's West Coast operations.

Promotion of **Neil E. Geisler** to the post of chief production engineer has been announced by Geuder, Paeschke & Frey Co. In this capacity, he will be in charge of drafting, tool trial, process and project engineering, and maintenance operations.





Left. **James M. White has been elected vice-president in charge of manufacturing for The Baldwin-Lima-Hamilton Corp. He had held a similar post at ACF Industries, Inc.** ***Center.*** **Robert B. Murray, Jr., former Undersecretary of Commerce, has been elevated from his post as assistant to the B-L-H president to become a vice-president and member of the board.** ***Right.*** **John R. Martin, Col. (ret.) from the U. S. Air Force, is new B-L-H vice-president in charge of electronics and instrumentation operations. The announcement followed a recent board meeting.**

Left. George F. Habach is now vice-president in charge of engineering at Worthington Corp. He is responsible for all engineering activity.

Right. Harry A. Feldbush, former vice-president in charge of engineering at Worthington, continues on the technical staff as consultant on special engineering problems.

J. W. Elliott, works manager of Brubaker Tool Corp., has been elected vice-president of the corporation. He will continue to serve as general manager of the Morton Machine Works, a subsidiary corporation.

A. D. Schultz has been promoted to the position of chief engineer of Eaton Mfg. Co.'s Stamping Div. Mr. Schultz, who has been associated with the firm since 1942, has been product engineer for the past five years.

Bertrand Y. Auger has been named technical director of the reinforced plastics division of Minnesota Mining & Mfg. Co. and will now be responsible for research and market development of new structural Scotchply materials. He formerly was general supervisor of Scotchply development.

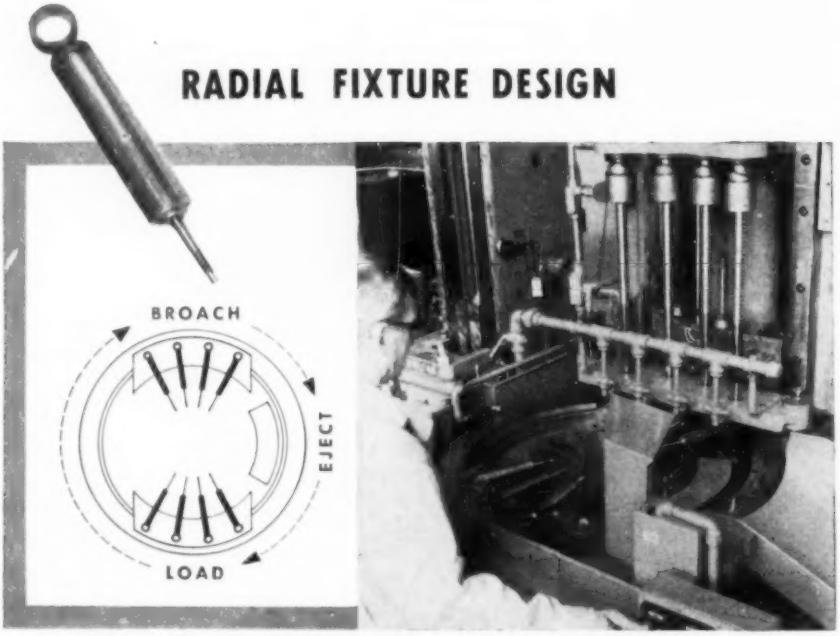
Appointment of **Roy H. Kallas** to the recently created post of general manager of Grieve-Hendry Co., Inc. has been announced. Mr. Kallas, who formerly was mechanical process equipment engineer with the Aircraft Engine Div. of Ford Motor Co., will have charge of the Chicago plant operation.

Orrin W. Barker is new vice-president in charge of engineering at Kearney & Trecker Corp. Formerly chief engineer, he succeeds Joseph B. Armitage who continues as vice-president-consultant.

The New York Air Brake Co. has announced appointment of **Frederick L. Guyette** to the position of chief plant and equipment engineer. A veteran of 25 years service with the company in various manufacturing capacities, Mr. Guyette now will be responsible for plant layout, machine tools, building and equipment for the company's five manufacturing divisions.

At the recent meeting of the board of Simplex Machine Tool Corp., **Lambert G. Neff, Sr.** was elected chairman of the board. **Lawrence J. Radermacher** became president, and **Vernon A. Forsberg** was named secretary and treasurer. Mr. Neff and Mr. Radermacher are members of ASTE's Chicago and Milwaukee chapters respectively.

Allen W. Salzman has joined Waukesha Tool Co. to assume the post of chief engineer and also to head the firm's new thrust bearing division. He formerly was associated with Racine Hydraulics and Machinery, Inc., as process and development engineer. Mr. Salzman is a member of ASTE's Racine chapter.



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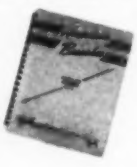

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Technical Shorts...

Develop Method For Bonding Carbide to Steel

THIN LAYERS of tungsten carbide are being applied to steel surfaces in such a manner as to form a metallurgical bond with the base material. The unusual technique, still in the appraisal stage, provides a truly sintered carbide structure. In this characteristic, it differs from previously developed methods for carbide coating. The new process has so far been used successfully for coating pickup pins, capstan rings, drill jig bushings and cylinder linings. Coatings are applied in thicknesses up to 0.030 in.

Two important possibilities are anticipated as outgrowths of the new process. Coated parts take on the wear retarding qualities of cemented carbides. In addition, the technique may be the means of overcoming design limitations associated with solid carbide parts.

* * *

Tool Measures Impact Stress Effect on Metal

EFFECT OF IMPACT on metals and plastics may be measured with an instrument recently developed in the research division of New York University College of Engineering. This "impact tube" instrument is designed to describe impact in terms of dynamic stress-strain relationships, which in each metal has a characteristic pattern. In previous studies, stress-strain results have been mixed with effects of waves brought about by sudden shock. In the new instrument, the two elements are separated.

Physically, the research tool is a 14 ft long steel tube 18 in. in diameter. The tube is divided into three chambers: a static, a dynamic and a firing chamber. The test specimen, in the form of a circular metal plate, is mounted between the static and dynamic chambers. The other end of the dynamic chamber is sealed with a plastic diaphragm supported by a pneumatically controlled piston. Pressure is built up equally in the static and dynamic chambers.

A carefully controlled simulated explosion supplies the impact. The diaphragm is ruptured first, sending an expansion wave from the mouth of the dynamic chamber to the specimen, at which point the pressure drops in about 1/100 second. The onrushing pressure from the static chamber crashes against the specimen and constitutes the impact loading. Force of the impact can be varied by changing the length of the dynamic chamber.

With the new instrument, effect of impact can be measured over the entire face of the specimen.

Studies of the response of aluminum, steel and titanium alloys to various loads and loading speeds already have been completed. The work is expected to be particularly valuable to designers of supersonic aircraft, equipment and buildings that may be under bomb blast, landing gear of aircraft, machine parts that are stamped out by heavy presses and other structures subject to sudden loads.

* * *

Report on Study Of Nickel Creep Characteristics

AS PART OF a long-range research program dealing with continuous deformation or creep of metals, the National Bureau of Standards has completed a study of those characteristics in high-purity nickel. Results indicated that this metal, which currently is widely used in high-temperature applications, creeps at relative-

GRINDING TIME CUT 50%

New Rotor D-4S Air Grinder pays for itself in 12 weeks

Job: Grinding defects in holes of castings with cone wheel (size 2¼" x 3½" x ⅛"). Formerly used 3600 rpm electric grinder (3 phase, 220v.). Job took 8 minutes—too slow.

Solution: Rotor Application Engineer suggested changing to Rotor D-4S Cone Grinder—speed 8500 rpm.

Results: Saves 4 minutes per casting; doubles output. With 50% use factor, savings paid for new Rotor Grinder in 12 weeks. Wheels last longer. Tool is lighter (only 8¼ lbs.); easier to handle. No tool stalling—even when crowded in hole.

Get the Rotor Engineer on *your* portable tool jobs to save *you* money!

APPLICATION

Rotor D-4 Air Grinders are available with straight or grip handle at 8500 rpm for cone wheels and 4" elastic wheels and at 6000 rpm for cone wheels, 6" elastic wheels and 4" vitrified wheels.

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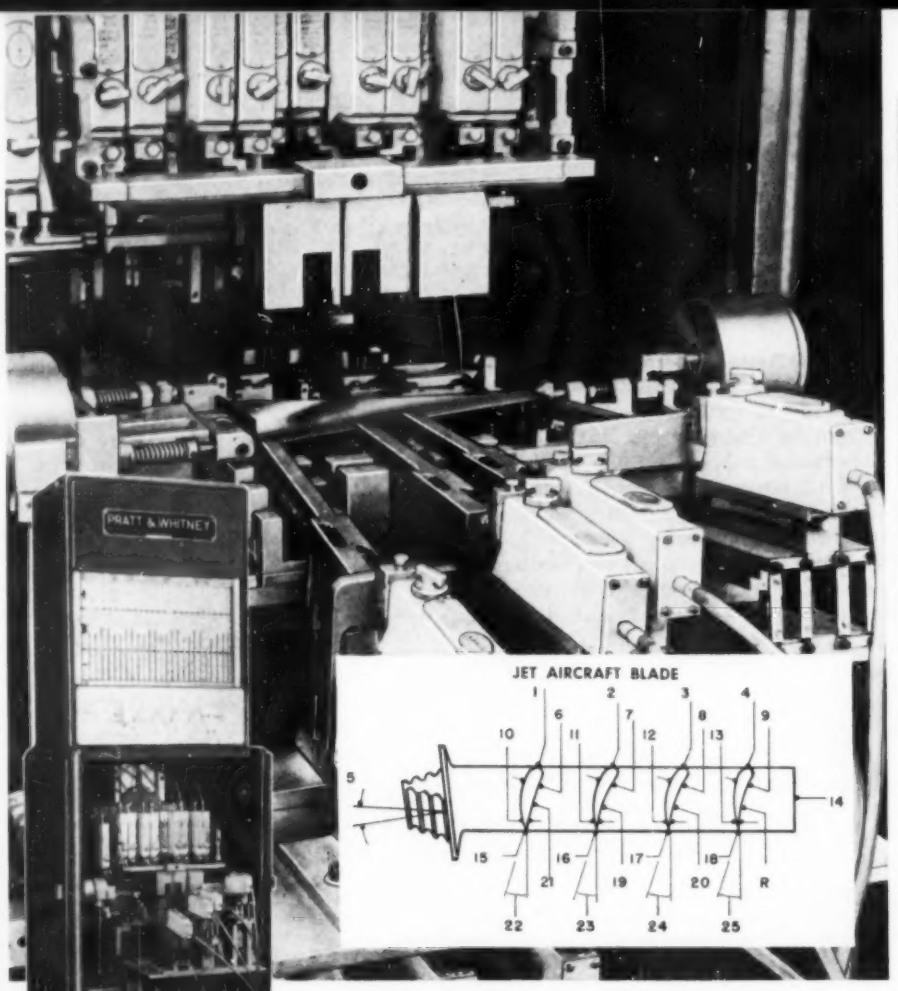

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MACHINE TOOLS • GAGES • CUTTING TOOLS

ly low temperatures. The researc carried out by W. D. Jenkins, T. Digges and C. R. Johnson of the B reau's thermal metallurgy laborato dealt with creep behavior in tension annealed specimens of high-purity nic el under constant load at 300, 700, 9 and 1200 F. It evaluated the influen of rate of loading on creep behavior a the effect of strain history on tensi properties of nickel at room temper ture. At 300 F nickel has a high resis ance to creep at all stresses up to 45,500 psi; with a further increase in stress of only 500 psi, secondary creep rate increased by a factor of about 100,000. Strain aging was particularly apparent at 300 F. Appreciable creep life appeared in some specimens loaded relatively slowly to stresses in excess of tensile strength of 46,400 psi at this temperature. Other phases of the study included contour and hardness surveys made both on specimens fractured in creep and on specimens fractured in tension at room temperature. Creep and tensile behavior of the specimens was correlated with their microstructures.

Three stages of creep were observed: first is one of decreasing rate of extension; in the second, creep proceeds at a nearly constant rate; in the third, creep rate increases, culminating in complete fracture. In the experiments, cracks of microscopic dimensions were not found to be a prerequisite for initiation of the third stage of creep. In all specimens tested at 300, 700 and 900 F in the NBS experiment, internal disintegration was confined to the region of complete fracture, and the fractures were preceded by appreciable necking.

Recrystallization, sometimes accompanied by grain growth, occurred in the specimens fractured in creep at 1200 F. No evidence of recrystallization was detected in a metallographic study of all the specimens fractured in creep at the lower temperatures.

• • •

Choice and Uses Of Pipe Threaders Covered by Film

PROPER SELECTION and use of portable pipe threading machines both in the shop and out on the job are dealt with in the new sound movie film, "Portable Parade," recently produced by The Oster Mfg. Co. The 16-mm color film, which has a 20-minute running time, is available on a free loan basis to engineering groups, trade associations, vocational classes and others interested in modern portable equipment for threading pipe or rods.

Arrangements for bookings should be made through the company, 2057 E. 61st Place, Cleveland 3, Ohio.

Who's Meeting - and Where

Dec. 7-9. AMERICAN INSTITUTE OF MINING & METALLURGICAL ENGINEERS. Electric furnace steel conference, William Penn Hotel, Pittsburgh, Pa. More details may be had from institute offices, 29 W. 39th St., New York, N. Y.

Dec. 7-9. NATIONAL ASSOCIATION OF MANUFACTURERS. Annual meeting and exhibit. Waldorf-Astoria, New York, N. Y. Further information is available from association headquarters, 2 E. 48th St., New York, N. Y.

Dec. 10-16. AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, sponsors of Atomic Exposition, Public Auditorium, Cleveland, Ohio. Get details from show management, International Atomic Exposition, 931 Book Bldg., Detroit 26, Mich.

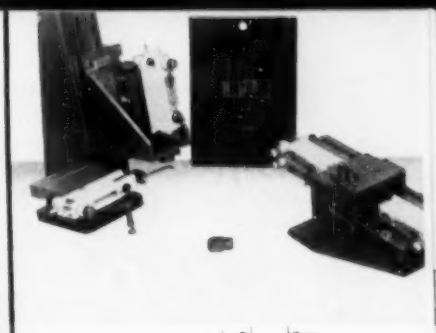
Dec. 12-16. ENGINEERS JOINT COUNCIL, coordinating Nuclear Engineering and Science Congress for 26 engineering and scientific groups. Public Auditorium, Cleveland, Ohio. More information may be had from Council office, 29 W. 39th St., New York 18, N. Y.

Jan. 9-13. SOCIETY OF AUTOMOTIVE ENGINEERS, INC. Annual meeting. The Sheraton-Cadillac and Statler Hotels, Detroit, Mich. For more details, contact society headquarters, 29 W. 39th St., New York 18, N. Y.

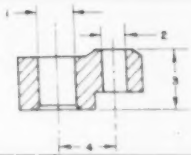
Jan. 18-20. SOCIETY OF PLASTICS ENGINEERS. 12th annual conference, Statler Hotel, Cleveland, Ohio. Details are available from S. A. McElroy, Hercules Power Co., 865 Union Commerce Bldg., Cleveland, Ohio.

Jan. 23-26. PLANT MAINTENANCE & ENGINEERING CONFERENCE AND SHOW, Convention Hall, Philadelphia, Pa. Complete facts are available from producers of the events, Clapp & Poliak, Inc., 341 Madison Ave., New York, N.Y.

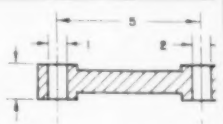
Feb. 1-2. ARMOUR RESEARCH FOUNDATION of Illinois Institute of Technology and Chicago Section of American Welding Society jointly sponsoring second annual Midwest Welding conference. Details are available from the Institute office, 35 W. 33rd St., Technology Center, Chicago 16, Ill.

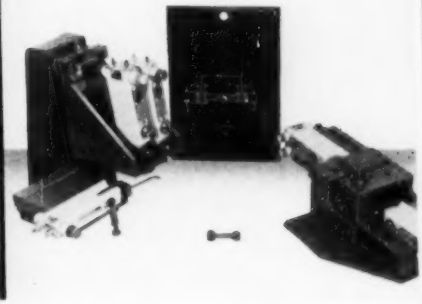


SEWING MACHINE PART



SMALL CONNECTING ROD





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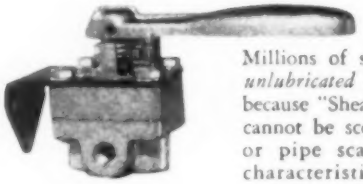
Manually operated 4-way valves for up to 250 P.S.I. air service. Port sizes ¼" and ⅜". With or without return (spring return to reverse or to center). Made entirely from corrosion resisting materials; stainless steel, bronze and aluminum.



With Spring Return

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Millions of service-free cycles even on *unlubricated* air. Leakproof to the end because "Shear-Seals" improve with use, cannot be scored or held open by dirt or pipe scale. Excellent throttling characteristics. Flexibility of porting and integral mounting bracket reduce installation cost.

COST:

$18.50 list price for a ¼", $19.50 for a ⅜" valve, less the usual trade and quantity discounts. Add $1.00 for spring return. Buy and try one on a money back guarantee, or write for complete literature 2801.

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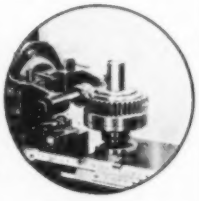
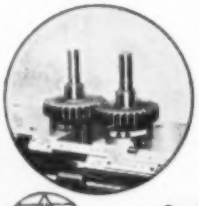
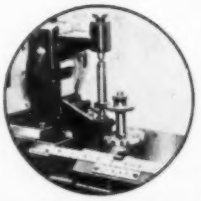
The Rolling Test is Practical Common Sense

- Indicates RUN-OUT, CENTER DISTANCE by 1/1000 vernier, BACKLASH, TOOTH JUMP, etc.
- It catches the error directly in the shop where the gears are cut.

The MODEL B shown takes in SPUR WORM SPIRAL and BEVEL GEARS from 1/4" to 9" Center Distance







STUDY THESE PICTURES and reflect how ingeniously and simple every gear problem has been solved, including pinions with shaft, small gear 1/2" center distance, worm gears, spiral gears and even bevel gears. All without extra attachments.

NOTE that in the PARKSON the tests are being made on fixed arbors or studs avoiding rotating shafts or bearings liable to introduce errors not in the gears themselves.

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good reading

DIE DESIGN HANDBOOK. *Published by American Society of Tool Engineers, 10700 Puritan Ave., Detroit 21, Mich. Price $14.50. $9.75 to ASTE members. 2150 pages.*

The *Die Design Handbook* was planned to provide die designers and users with rapid access to the distinctive design details of hundreds of dies that have proved superior in cold metal pressworking operations.

The general topics are so laid out that the pattern follows the actual steps taken by die men from inception through the finished product. Covering design of stampings; die design economics; theory of metal movements; materials; die setting principles; and selection of presses, the Handbook is cross-referenced to pinpoint needed information. It contains 632 drawings, charts, and nomographs in conjunction with 161 reference tables; also, little-known data on designing dies for non-metals of various types.

Compiled under Frank W. Wilson, Editor-in-Chief, each section was reviewed by at least five different experts to assure authoritativeness and readability.

The Handbook contains collective knowledge and experience of hundreds of companies, trade associations and technical societies, and individual authorities in every phase of die design and application. Much of the specialized data presented is unpublished manufacturer's private standards and practices.

MACHINE SHOP OPERATIONS AND SETUPS *by H. Porter, C. Lawshe and O. Lascoe. Published by the American Technical Society, 848 E. 58th St., Chicago 37, Ill. 397 pages.*

Specific requirements of modern instruction in machine shop techniques are discussed in this book. The authors, guided by the results of a survey, have incorporated new operations into the text and have repudiated the practice of useless repetition of out-of-date methods. Grinding operations, often omitted in some texts, are included.

How To Use and Maintain Gear Cutting Tools. *Published by Gear Generating Tools Sub-Division of the Metal Cutting Tool Institute, 405 Lexington Ave., New York 17, N. Y. Price $1.00. 32 pages.*

The purpose of this booklet is to help gear producers get the most from gear cutting tools. Various chapters deal with each basic tool, starting with a description of variations in the basic type of tool and why these variations are important. Also covered are proper mounting of tools and workpieces, proper feeds, speeds, coolants, sharpening, inspection and storage.

Magnetic Control of Industrial Motors *by Gerhart W. Heumann. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price $9.50. 714 pages.*

Contained in this new edition is an analysis of all modern types of motor control, data on their engineering application, and general maintenance information. Reference material has been expanded, with emphasis on the theoretical background underlying national standards and safety codes.

How To Get the Most Out of Your Turret Lathe. *Published by the Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio. Free on company letterhead. 158 pages.*

A series of articles in this book discuss case histories which collectively show how to achieve maximum production with minimum effort.

Much of the material lies in the area of organizing the work prior to actual metal cutting. Work planning, esablishing job sequence, selection of tooling, and minimizing setup requirements are among the subjects discussed.

Machining Kaiser Aluminum. *Published by the Technical Publications Department, Kaiser Aluminum & Chemical Sales, Inc., 228 North LaSalle St., Chicago 1, Illinois. Free on company letterhead or $2.00 for personal libraries. 320 pages.*

Contains data on all phases of machining aluminum, derived from both research and practical experience. Logically divided into the operations performed, it is selective for use in specialized fields as well as normal operation.

Technical discussion of types of aluminum, cutting fluids and advanced machine methods, are supplemented by illustrations and field studies.

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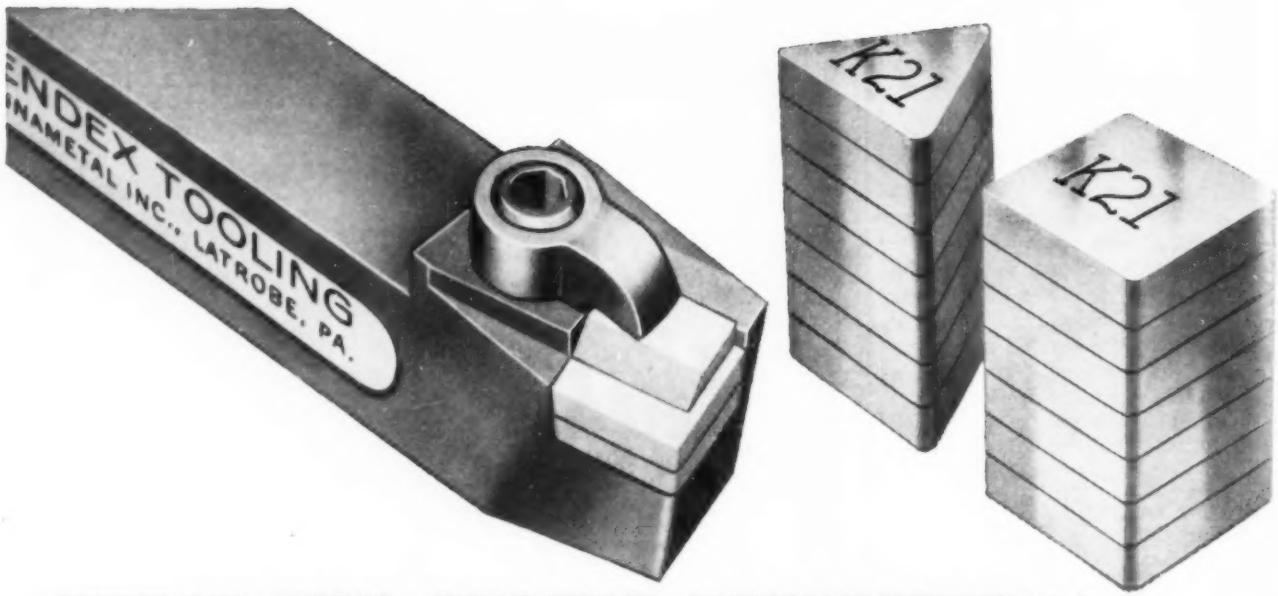

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The profit advantages of today's high-speed automatic cycling machines for metal cutting are lost when tools wear rapidly—need frequent regrinding—or are cumbersome to index.

Kennametal recently introduced two new developments to help give you continuous machine performance, and to help step up profits in your steel-cutting operations. These developments are Kendex*† Button Tooling and Kennametal Grade K21.

Kendex "turnover" inserts, with replaceable Kennametal shims and new chip control system, double the number of cutting edges, eliminate all regrinding and index in seconds. These features help provide consistent tool performance and hold downtime to a minimum.

Grade K21 is the General Purpose steel-cutting carbide now outperforming all other medium grades in the carbide industry. Superior performance of K21 is due to exceptionally high edge strength, strong resistance to cratering and superior wear qualities. An extremely versatile grade, K21 can be applied to general steel-cutting, heavy roughing and finishing.

Kendex, in 17 styles and sizes; and K21, in popular blanks and inserts, are immediately available from stock. For their right application on your machining jobs, call a Kennametal Tool Engineer. He works exclusively with Kennametal . . . applying and servicing it. And be sure to ask for reports of Kendex and K21 repeat performances, job after job. KENNAMETAL INC., Latrobe, Pa.

*Registered Trademark †Patent applied for 9409

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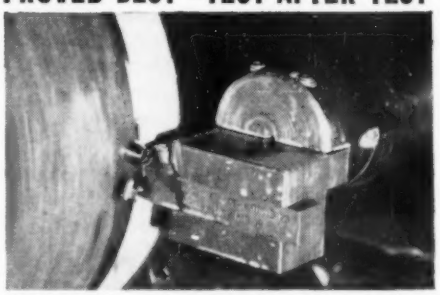
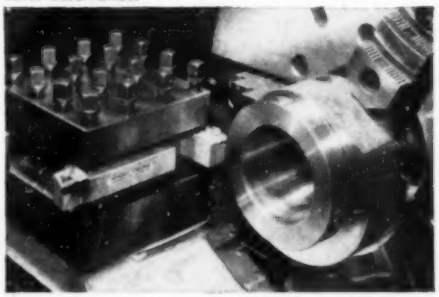


Kendex Tooling with "turnover" inserts cuts tool cost from $1.20 to $0.09 per piece, turning SAE 4140 tank assemblies.



Grade K21—on interrupted cutting, roughed and finished 6 times as many pieces as other premium carbide.

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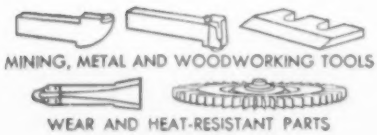

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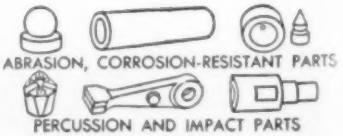


Advances in Engineering Communications

technical digests

By Ray Bell
Power Equipment Div.
Allis-Chalmers Mfg. Co.
Milwaukee, Wis.

MECHANICAL DRAWINGS are an extremely important link in the chain of communications of an industrial plant. In the past these lines of communications were short and simple. Drawings for any piece were simple and it was customary to add to them an artistic touch which made them almost picture-like. The drawings carried intelligence directly to the workman doing the actual fabrication.

Mechanization has brought about a change in the channels of industrial communication. Today, more and more drawings are going to programmers who convert the information on the drawings into machine settings. Machine operators in these instances have no need to see the drawings.

An example of this change is shown in the old and new methods of producing panels for electrical switchgear. These panels are formed from sheet steel with square and other shaped openings in them for mounting of instruments and other devices. In the past the detail drawings of the panels were given to layout men who inscribed on the sheet steel the outlines of the instrument and other cutouts. The cutouts were then nibbled or sawed out.

Today, a special multiple head punch press is used. The operator has only a tabular drawing on which is given the coordinate settings for the movable table on which the sheet steel is clamped and the number of the punch head to be used. The operator does not see a detailed drawing of the panel.

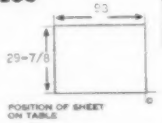
The advances being made in the use of automatic materials handling equipment and automatically controlled machines foretell the plant of the future. In this plant one can foresee, for example, manufacturing information in the form of a pack of cards being fed into a master machine. This master machine will impart the necessary set-up information to the drill presses, grinders, shapers and other machine operations. The material will be automatically removed from stock and delivered to the machines, and the finished piece will be tested and delivered to the next line. All this without a workman having to handle the work.

Drawing Practices Changing

Mechanical drawing practices must be made more efficient and adapted to these changes. All processes must continue to progress with manufacturing practices to reduce costs and improve productivity. Teachers of this impor-

CHART FOR TURRET PUNCH PRESS

ORDER NO.	PANEL ARR.	UNIT NO.
2-1935C 33674	18-439-18	UNIT 2,3,4,5,6
2-1935 34242	18-545-872	LT.25 LT.56 UNIT 46

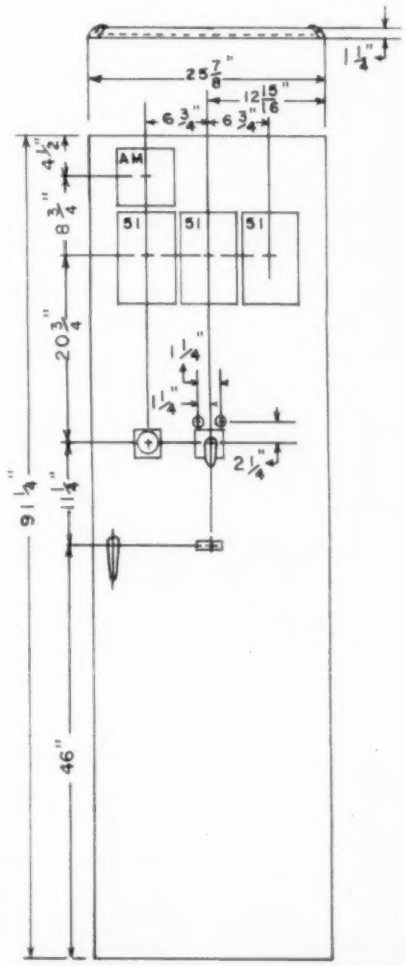


DETAIL DRG. No. 18-356-251
SHEET SIZE #11 GA. x 29-7/8" x 93" LG. BHT. STL.

BEFORE STARTING TO PUNCH SHEET, CHECK THIS CHART AGAINST TURRET DIE CHART TO DETERMINE THAT DIES ARE IN THEIR PROPER STATIONS

PUNCH NUMBER	TABLE SETTINGS IN & OUT	TABLE SETTINGS CROSSWISE	PUNCH NUMBER	TABLE SETTINGS IN & OUT	TABLE SETTINGS CROSSWISE
S 29	.375 *	4.125 *	S 27	.562 *	17.000 *
S 29	.375 *	8.125 *	S 27	.562 *	17.500 *
S 29	.375 *	12.125 *			
S 29	.375 *	19.125 *	S 22	4.187 *	.375 *

Sample of tabular chart which replaces drawing for machine operator.



Simplified drawing made possible by programming of automatic machine.

tant subject must, therefore, keep in touch with industry and its over-all developments, and must continually re-evaluate the subject to keep it in step.

This is a tremendous challenge. The need for new ideas in this field, for new techniques, for new understanding is almost beyond measure. The teachers should share in solving the problems that are to be faced in developing the future. That is their duty and also, by the same token, an opportunity for personal and professional progress.

From a paper "Let's Look to the Future" delivered before the American Society of Education, Engineering Drawing Div., June 21, 1955.

▼ ▼ ▼

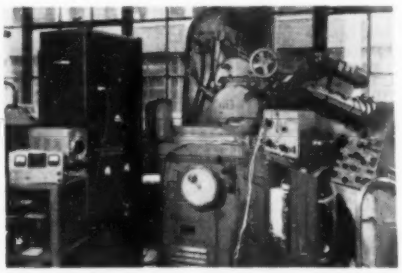
Use of High-Frequency Vibrations in Grinding

By L. V. Colwell, Professor
Dept. of Production Engineering
University of Michigan
Ann Arbor, Mich.

Surface finishes produced on steel by grinding can be improved by high-frequency vibrations. Results of investigations definitely demonstrate that small vibrations at high frequency can improve surface finish, reduce temperature in the ground surface, reduce the incidence of thermal cracks, and can minimize the effects of variations in hardness within a grinding wheel. The studies indicate the possibility of applying high frequency and even ultrasonic vibrations to selected operations to improve the grinding process. In the tests, vibrations were induced artificially between the workpiece and the grinding wheel by vibrating specimens with an ultrasonic transducer.

Skilled operators have insisted for years that they could grind metal by ear. Actually, the operator relies on the sounds to guide him. These sounds are, of course, created by vibrations in the grinding zone. They may be wheel vibration, or some combination of wheel, spindle and work vibrations. A simple survey of the intensity of sound at different frequencies in a grinding operation has shown substantial intensity at frequencies even up to 20 kilocycles which is beyond the threshold of human hearing.

Grinding tests were performed in which vibrations of 0.001-inch amplitude at 10 to 18 kilocycles per second were induced between workpiece and grinding wheel by vibrating specimens



Laboratory equipment for studying the effect of induced ultrasonic vibration in surface grinding.

with an ultrasonic transducer, consisting of core of ten sheets of pure nickel wound with a coper wire coil in which alternating current was applied. This setup is shown in the accompanying illustration. The electrical apparatus at the left of the grinder provides high-frequency power to the transducer which vibrates the work specimen radial to the grinding wheel. Instruments to the right of the grinder record input power to the spindle and work temperature. The close-up shows the arrangement for vibrating the workpiece and also recording work temperature. The thermocouple for temperature recording is imbedded in the center of underside of the test specimen.

Surface roughness measurements and microscopic examinations of the grinding swarf, or dust, obtained during dry grinding, showed a 60 percent reduction of roughness, from 40 to 16 microinches rms, when grinding hardened 52100 steel with an F-grade aluminum oxide wheel (DA60-F9-V20). The depth of cut was 0.002 inch and the cross feed was 0.050 inch. Peak temperature was reduced from 475 to 255 deg F as measured by thermocouple

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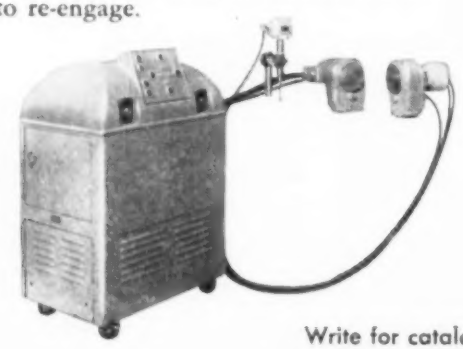
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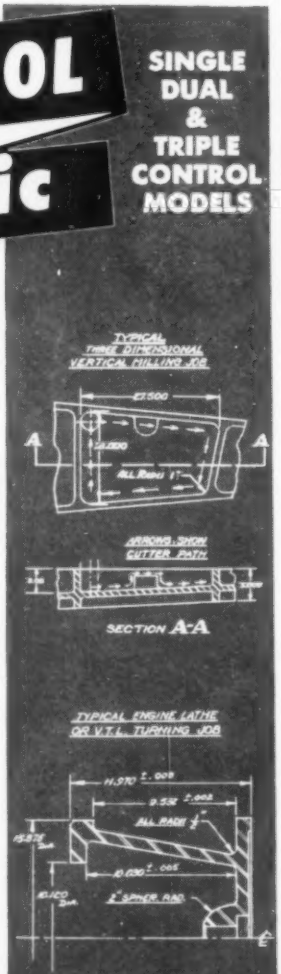

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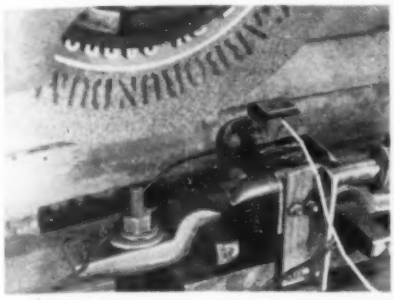
oscilloscope.

t appears generally true that vibra- causes more wheel breakdown than nventional grinding. This was not nexpected. Studies of grinding ratio ve confirmed varying degrees of more



Magnetostrictive transducer with temperature specimen cyclewelded to laminated plastic support.

rapid wheel breakdown, particularly just after redressing. This is attributed to fewer and smaller built-up edges, and to continuous, uniform redressing which results from fragmentation of individual abrasive grains.

While there is little doubt that such vibrations can produce desirable results much more work needs to be done to clarify the mechanism of its effectiveness. Even more needs to be done to learn how to apply it to industrial grinding. It is fascinating to consider, however, that even now benefits may be derived from ultrasonic vibrations in industrial grinding without the user knowing it.

From ASME paper No. 55-SA-12 given at the semiannual meeting, Boston, June 1955.

▼ ▼ ▼

Goals of Engineering Education

By C. E. Reed
General Electric Co.
Waterford, N. Y.

Because of the greater demands being placed upon technical personnel by industry and limitations of qualified engineers, the efficiency and productivity of the profession must increase at a rate more rapid than for industry as a whole. This presents an enormous challenge to engineering education. Many educators are alert to the new demands as shown by broad gage surveys and reports. There are many signs that some really revolutionary changes are coming in the traditional engineering curricula. Prior to such changes in

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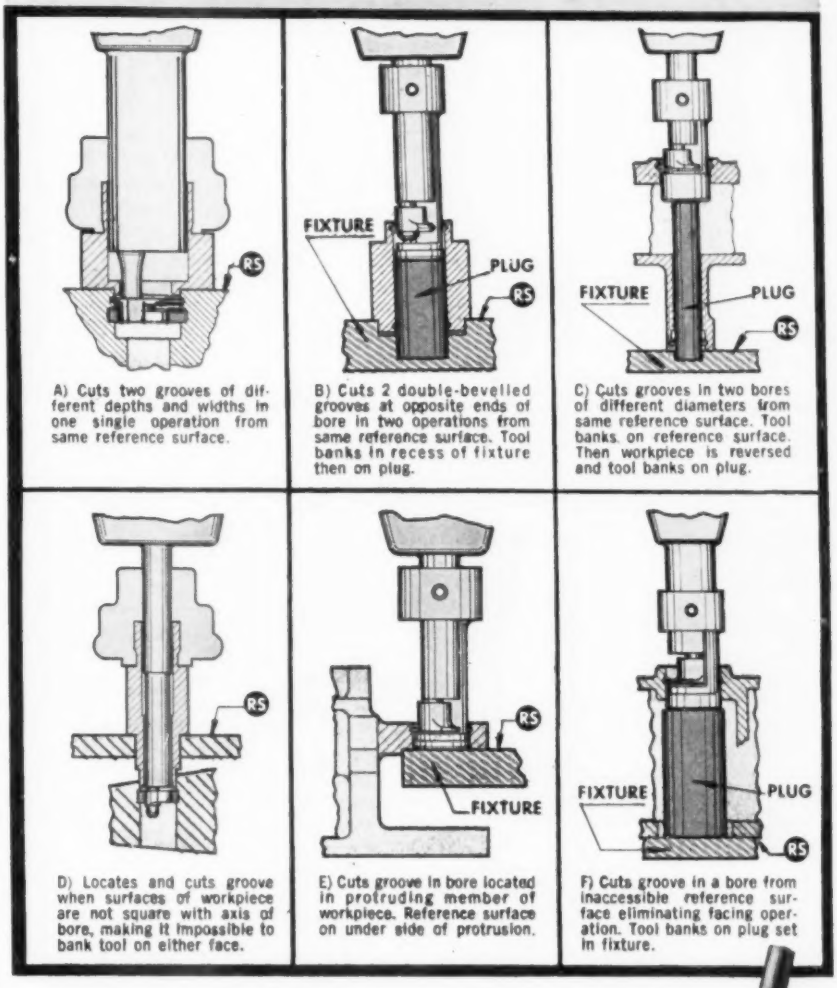

A) Cuts two grooves of different depths and widths in one single operation from same reference surface.

B) Cuts 2 double-bevelled grooves at opposite ends of bore in two operations from same reference surface. Tool banks in recess of fixture then on plug.

C) Cuts grooves in two bores of different diameters from same reference surface. Tool banks on reference surface. Then workpiece is reversed and tool banks on plug.

D) Locates and cuts groove when surfaces of workpiece are not square with axis of bore, making it impossible to bank tool on either face.

E) Cuts groove in bore located in protruding member of workpiece. Reference surface on under side of protrusion.

F) Cuts groove in a bore from inaccessible reference surface eliminating facing operation. Tool banks on plug set in fixture.

Amazingly versatile! Your toughest recess cutting problems can be met simply and efficiently with the Waldes Truarc Grooving Tool because it offers a whole range of possibilities beyond the range of ordinary recessing tools.

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curriculum, the decision must first be made on educational goals. From the management viewpoint of industry, the description might be as follows: At the time of his graduation from college and entry into industry he would be essentially a problem solver on technical problems of limited scope. He would not be expected to be familiar with any of the technological details of the industry he has chosen to enter. He would be thoroughly familiar with fundamental facts, theories, techniques and tools of the basic physical sciences, mathematics, chemistry and physics. With these, he would be able to tackle his problems in terms of a basic scientific approach.

His college career would have instilled into him such a degree of intellectual curiosity that he would have an almost insatiable desire to find out why he has been asked to solve the particular problems assigned him. This inquiring spirit would lead him to naturally acquire a detailed knowledge of the technology which developed before his appearance on the scene. His background in basic science would enable him to comprehend technological knowledge as rapidly as needed on the job. More importantly, however, he would acquire this technology in a constructively critical spirit. While respecting accomplishments of the past, his intellectual curiosity and thirst for new knowledge would impel him to keep an open mind in search of initiative and perseverance for more efficient and economic ways of doing things. He would follow curiosity with creativity.

His background in science would have provided him with the fundamental tools and instilled into him a spirit of intellectual adventure which could serve as the basis for continued self-development throughout life.

The ideal engineering graduate should have received training in the balanced judgment type of thinking in arriving at decisions and at the solutions to problems. In addition, he should have acquired a beginning in understanding himself in his relations to other people. It is impossible to understand other people and work with them effectively unless one acquires self-understanding of the true reasons underlying his own attitudes, actions, motivations and emotions.

From a paper delivered at the symposium on chemical engineering curriculum at the Houston meeting AICE, 1955.

▼ ▼ ▼

Training Plan for Executives

By John Markle II

Vice President, Personnel
Bell Telephone of Pennsylvania
Philadelphia, Pa.

Business leadership once called for knowing the business; today and tomorrow it also calls for knowing mankind.

Training men for policy-making positions is increasingly a problem in modern business. Top executives spend their early careers in lower or middle management jobs where their responsibilities are primarily for production, sales, or other day-to-day operations. Most of them have had specialized educations, and even if their training was in liberal arts the internal competition in the business will motivate an ambitious youngster to devote his time to reading technical books and learning the mechanics of the industry. The functionalization of most businesses has tended toward the development of specialists.

The second part of the problem is the social revolution of the past 25 years. The perplexing problems of today and tomorrow are in the field of human relations. The effects are felt of the increasing influence of social, political, and economic changes, and thus a business now has to conisder itself in relation to the community, to the nation, and to the world as well as its position within its industry.

In the future business will need more creative insight and wider range of reference—particularly in the fields of human behavior. The problem is how can future higher management people be

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2nd They absorb thrust and radial loads beyond requirements—basic rating on front bearing at 500 R.P.M.
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4th They *hold* the spindle in rigid alignment while permitting it to turn freely at high or low speeds—the line contact between rolls and races, and the opposing taper design, preclude lateral movement or end play.

5th They *minimize* friction—smooth mirror finished rollers and races running in light oil, deliver more horsepower at the Spindle Nose and lower power costs.

6th They *increase* work capacity. Larger than similar type bearings on other lathes in this price range, these bearings make it possible to turn out *more work* and *better* work at lower costs.

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veloped to meet industry's need.

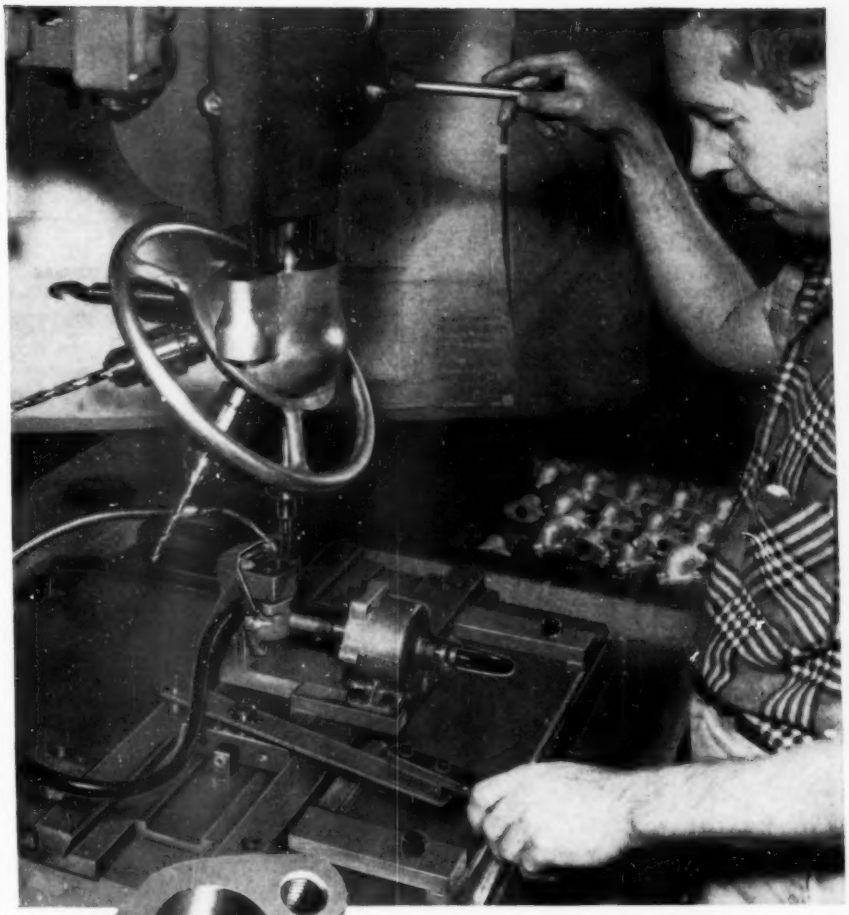
A management educational program the humanities was started by Bell elephone of Pennsylvania at the Uniersity of Pennsylvania for the following objectives:

1. Enable a future executive to understand and interpret the social political and economic changes that will influence the problems of corporate management
2. Indicate the importance, impact, and use of history, science, philosophy, and the arts in the world today, particularly as they influence large groups of people
3. Motivate the participants in the program to accept the concept of intellectual activity as a never-ending process to be continued throughout life
4. Balance with a humanistic background the attention generally given by younger men to acquiring technical knowledge and competence by working in an atmosphere of intense competition with other individuals
5. Offset a tendency toward overconformity in a highly specialized business that promotes almost entirely from within the organization.

Students, averaging 37.5 years of age, were selected from jobs at the third level of supervision or higher. Teaching methods include lectures, discussions, seminars and field trips. The 10-month curriculum covers 15 courses of varying lengths; among them, practical logic, business today, business history, history of economic thought, world art, history and aesthetics of music, analytical reading, world literature, social science, philosophy of ethics, history and meaning of science, James Joyce's "Ulysses," modern architecture and city planning, American civilization, political science, and international relations.

Since the primary function of the instruction is to help the mature individual to organize unfamiliar data and experiences in a meaningful and useful manner, the instructors and lecturers are urged not to present a comprehensive survey of various academic disciplines. Rather, they are asked to stimulate the student's interest in new material and new ways of thinking. Throughout the course the students are encouraged to reach their own conclusions about new areas of knowledge.

One outcome of the program has been an increase in effective oral expression. Students who participated, increased personal identity and self-realization. They have become better family men,



PRODUCTION UP 53%

FEWER REJECTS

HOWE & FANT TURRET DRILL CASE HISTORY

#25

Part — Aluminum elbow

Fixture — 3 position, lever transfer, air clamp, bolted to machine table.

Operations

I Load. II Spot 2 holes 3/8 x 90°. III Index turret and drill 2 holes .272" dia. .625" deep. IV Index turret and tap 2 holes 5/16—24 class 3 fit .520" deep. V Index turret and core drill 1 hole .801" dia. .410" deep. VI Unload and clean.

Production rate — 73.2 pieces (512.4 machining operations per hour).

Comment

Job is a "natural" for the H&F turret drill. Part is clamped by air in simple fixture lever actuated to provide 3 predetermined working positions. This assures minimum transfer time and proper location of part under working tool. Each tool turns at optimum preset speed in this case:

Spot drill	1825 r.p.m.
.272" dia. drill	2375 r.p.m.
5/16—24 tap	1150 r.p.m.
.801" dia. core drill	825 r.p.m.

Tap automatically reverses at twice forward speed at preset depth. All depths controlled within .002".

Set-up increases production 53% over 4-spindle drill press with box jig. Rejects are virtually eliminated, tool life greatly increased. The H&F installation has won unanimous operator approval by appreciably cutting fatigue while increasing output.

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hf HOWE & FANT, Inc.

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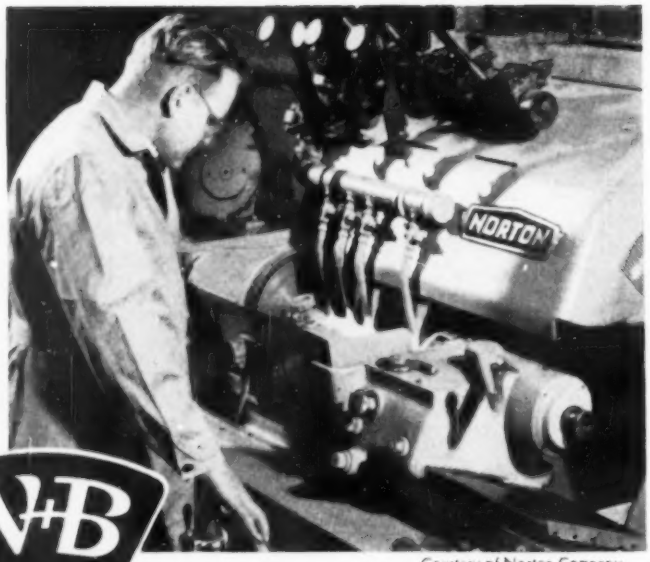

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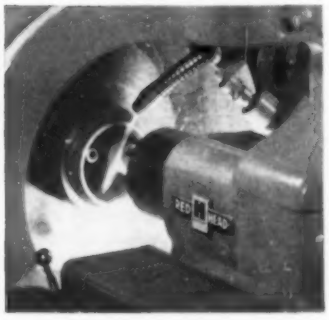
W & B Has Always Delivered for this all-important reason: We have been specialists in the development and application of lubricants for metalworking since 1888.



For example, widely-used W & B Base L, a comparatively light-bodied sulphurized fatty base, is a concentrate used to blend or fortify a wide range of metalworking lubricants for machining, grinding, drawing. W & B Base L mixes quickly and easily with petroleum oils in all proportions to provide efficient metalworking oils at low cost.

Do *you* have a metalworking problem? Ask us, without obligation, to send a W & B Lubrication Expert into your plant to consult with you.

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better citizens in their communities, and better individuals.

The future of this civilization depends upon the re-establishment and continuance of a high level of leadership. The management educational program in the humanities may or may not be the final answer—but it seems to be a start in the right direction. At least a contribution is made to meeting what is currently the most important problem facing the corporate future.

From a talk given at the American Management Association Conference, Hotel Roosevelt, New York, N. Y., May 23-25, 1955.

▼ ▼ ▼

Progress Report of Production Welding

By John L. Lang
Welding Engineer

Lukens Steel Co.
Lukenweld Div.
Coatesville, Pa.

The almost universal application of welding processes to metal fabricating is something that has developed only in the last decade or so. When a new metal is discovered today, or a new alloy developed, one of the first questions concerns is its weldability. New applications are constantly being developed in this field.

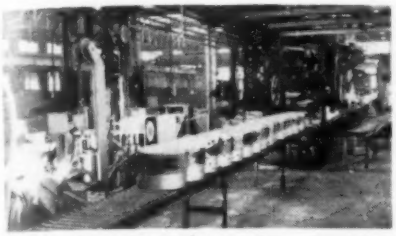
One interesting such application is the production of diesel engine frames of 304-18-8 stainless. Manual shielded metal-arc welding is the process used. Compared to an old style cast-iron diesel engine, the new design results in a reduction of 67.39 percent in cu ft occupied per bhp and a reduction of 58.40 percent in weight per bhp.

Another application of shielded metal-arc welding is in fabrication of large power plant weldments. Low pressure turbine cases are fabricated entirely of roll plate, gas-cut, machined, formed and welded. Large stator frames are fabricated in the same manner from plate stock and welded into a homogenous mass.

There are other interesting automatic applications of inert gas shielded metal arc process using nonconsumable electrodes. With the same process, using a consumable electrode, the welding of aluminum, copper and its alloys, stainless steel, steel and titanium have been greatly facilitated. An application of this process to mild steel is the fabrication of refrigeration compressor cases of 5 hp size. The accompanying illustration shows a view of the production line set up for fabrication of the cases. Sixty units are assembled, welded and

ed in an 8-hour shift. Two inert gas elded metal arc units were used in lding the 110 inches in the three in joints of this operation.

New resistance welding applications ch as spot, seam and projection weld-



Production of refrigerator compressor cases by inert gas shielded metal arc consumable electrode process.

ing are being widely used. For instance, in fabrication of electric ranges, 235 individual pieces are joined by 1150 spot and projection welds. These require just under one hour of productive labor including handling of parts.

Flash welding is another resistance welding process being used extensively. A midwest company fabricates 40-ft section of pipe by flash welding the entire length in one operation in about 35 seconds. A large flash welder is being used to fabricate crankshafts. The process is also used extensively in automotive body fabrication. With another process equipment is used in the automotive industry to make 30,000 welds an hour.

Another development is the use of iron powder-type electrodes for shielded metal arc welding. This appears to have great potentialities for the future. As industry takes greater advantage of automation, welding will play a key role. Only welding can join metal parts in continuous and high-speed processes which automation demands.

From a paper presented at the ASME Baltimore meeting, April 1955.

▼ ▼ ▼

Safeguarding Workers' Health

By I. Matelsky

Industrial Hygienist
General Electric Co.
Cleveland, Ohio

Canned music and pastel paints can help boost factory production. Few doubt the increase in morale and decrease in boredom and accidents when industry changed from dirt-hiding dark colors to more pleasing shades in their plants. Nor can anyone seriously find objection to the use of canned music in the plant to cover the monotony of dull background noises.

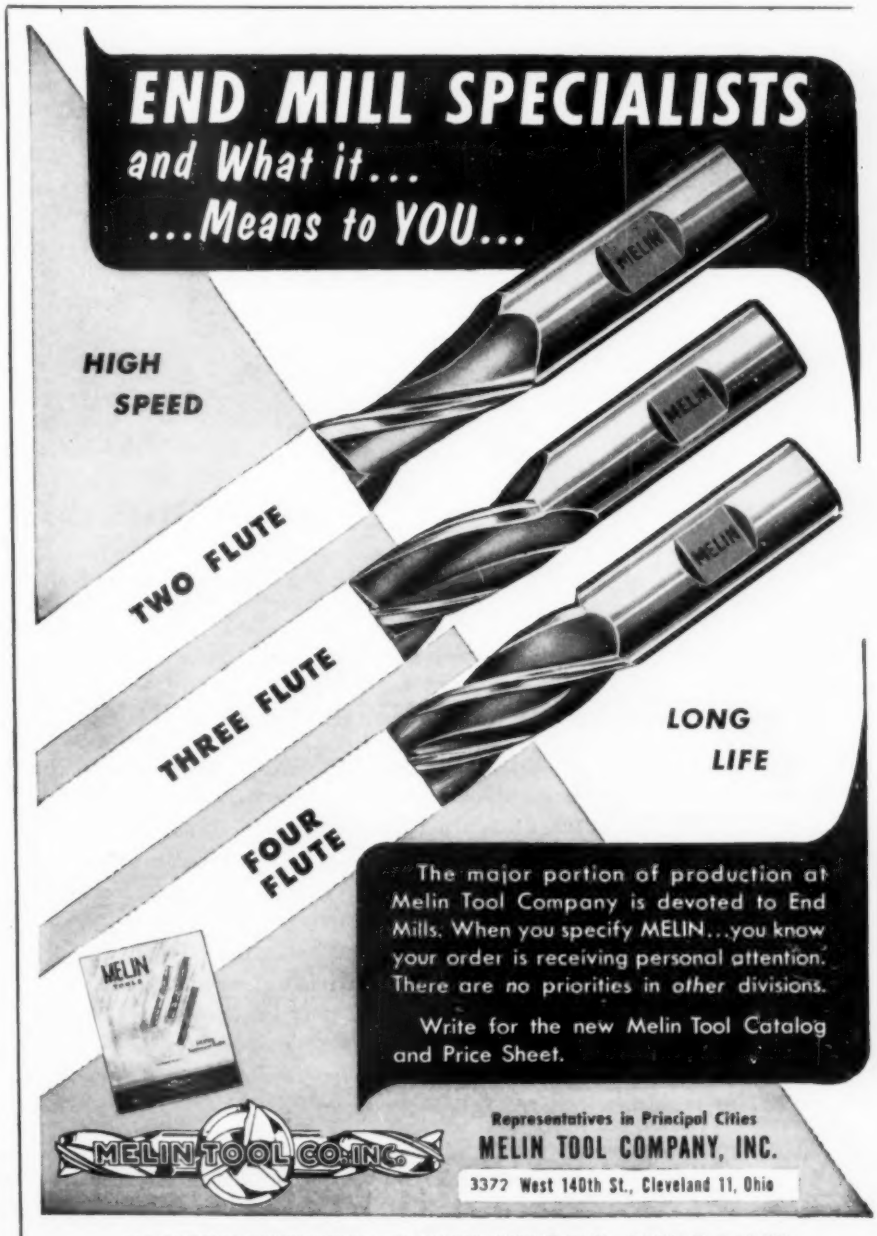
Industry realizes that a healthy worker is a good worker. Great progress has been made since the industrial revolution, when poor factory practices took a great toll in human lives and health. Health teams, consisting of the industrial physician and nurse, the safety engineer and the industrial hygienist, are at work throughout industry to recognize, appraise and establish corrective and control measures for occupational diseases.

Even this is not enough, however. Industrial health control should begin before a plant is built. It should be considered in the blueprint stage, by the architect, the plant layout men and the designers of machines and equipment.

Four main factors of the workers' environment are: chemical, physical, biological and psychological. Chemicals may cause harm not only through inhalation, but through skin absorption, resulting in dermatosis. Despite the fact that there has been more time lost from work, and more time paid out as compensation for occupational dermatitis than for any other occupational disease, much less attention has been paid to the prevention of this malady than to prevention of poisoning.

Physical agents are usually more subtle in their effect than chemical agents. Noise above a continuous pitch level of 85 decibels may be injurious, and even noninjurious noise of the nuisance variety may result in fatigue and decreased efficiency.

Good illumination results in greater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THREE FLUTE
FOUR FLUTE
LONG LIFE
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The major portion of production at Melin Tool Company is devoted to End Mills. When you specify MELIN...you know your order is receiving personal attention. There are no priorities in other divisions.
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T-J RIVITOR . . .

8″ throat . . . feeds and sets rivets with special 10 station indexing fixture. Has air operated hold down mechanism and special air circuit to provide automatic indexing.

T-J CLINCHOR . . .

one of six special 8″ throat Underfeed Clinchors used by a large automotive body manufacturer. Feeds and sets square cased nuts in outside quarter panels, left and right hand.

AUTOMATIC FEEDING and SETTING

More and more . . . T-J Rivitors and Clinchors meet today's demands for faster assembly on a wide range of jobs . . . in aircraft, automotive, farm machinery, stampings of all kinds.

T-J CLINCHORS set clinch nuts with fully automatic operation, controlled by a single foot pedal. Available in Underfeed and Gravity feed models, throat depths 8″ to 36″.

T-J RIVITORS automatically feed and set solid rivets with high production. Electrically powered Rivitor sets solid steel rivets up to ⅞″ long. Air-powered sets aluminum alloy rivets or steel rivets up to ¾″ long. Throat depths 8″ to 36″.

Write for Clinchor bulletin 847; Rivitor bulletins 646 and 847. The Tomkins-Johnson Co., Jackson, Mich.

T-J **TOMKINS-JOHNSON**

RIVITORS . . . AIR AND HYDRAULIC CYLINDERS . . . CUTTERS . . . CLINCHORS

38 YEARS EXPERIENCE

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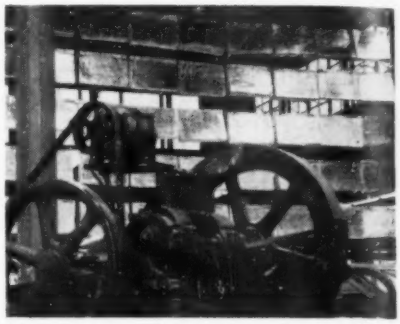
accuracy in workmanship, increased production, improved morale, better sanitary maintenance and greater safety. Other physical factors are excessive heat and infrared, ultraviolet and ionizing radiation. There are, however, opposing views concerning sterilization of indoor air to prevent respiratory infections.

One of the most important aspects of this field, and one of the most concern in the field of mechanical engineering, is the lack of regard for the human physiological and psychological responses in the design of plants and



In existing plants, sound absorbing baffles are used to help prevent noise from one area reaching another.

machines. It is possible to calculate to a nicety the exact stresses and strains that may be developed in a machine without injury to that unit, but it is much more difficult to evaluate the stresses and strains that may be set up in the operator. Machines are designed that need split second timing by workers whose split second response capabilities have not been investigated. When this difficulty is realized, automatic controls are designed of so complex a nature as to become nothing more than a bewildering mass of dials and switches to the operator.

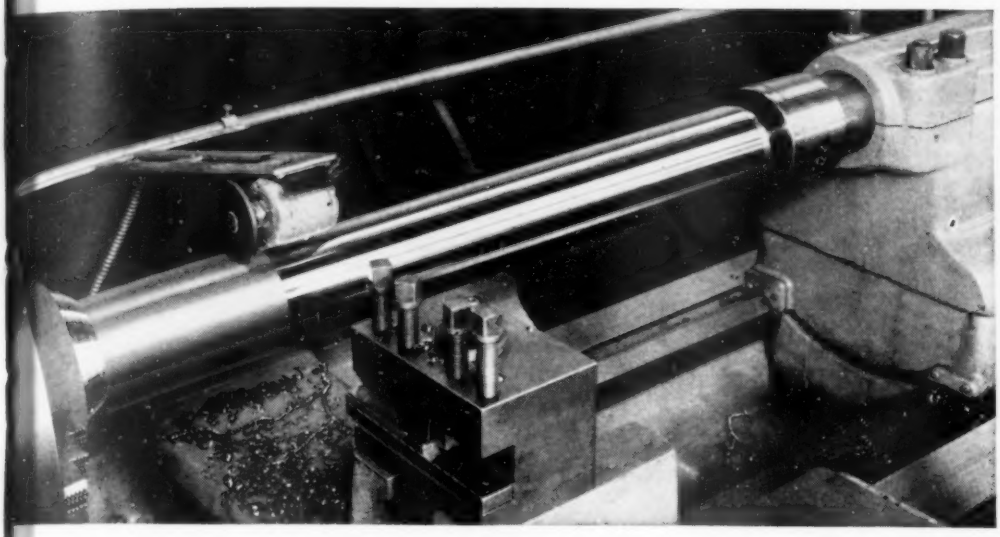
What is needed in order to control these psychological hazards is a greater interest and activity in the fields of applied physiology and psychology and further development of that field.

Industrial management has shown interest in other fields not discussed here, such as ventilation and air conditioning for workers' comfort and smoke abatement and waste disposal programs for community benefit.

Huge sums of money have been spent for the preservation of good health in workers. This has proved a good investment. With ever changing and new materials and processes being developed, industrial hygiene and medicine must constantly be in a dynamic state to anticipate and prevent harmful situations.

From a paper delivered at the ASME semi-annual meeting in Boston, June 1955.

Normal speed for finishing this AISI 1045 shaft with carbide is 500 sfpm. (See tachometer above.) Only 7.4 cubic inches are removed in 2 minutes with .010" feed, 1/16" depth of cut.



With Carboloy Cemented Oxide, speed increased to 2000 sfpm, and 29.6 cubic inches were removed in the same time, under identical cutting conditions.

Limited offering available January 1 . . .

FINISH STEEL AT SPEEDS UP TO 7500 SFPM WITH NEW CARBOLOY CEMENTED OXIDE TOOLS

Carboloy® Cemented Oxide is an entirely new kind of cutting material, specially developed for steel finishing at speeds ranging from 300 to 7500 sfpm.

To date, Cemented Oxide tools have been used to cut steel with Brinell readings up to 300. Results have included more metal removed per minute, with finishes superior to those possible with carbide or HSS.

Tip stays cool

Performance evaluations at the Carboloy machinability laboratory and in customer plants prove Cemented Oxide cuts cleanly, resists edge wear and cratering. Even at extremely high operating speeds, the tip remains so cool it can be touched immediately after the cut.

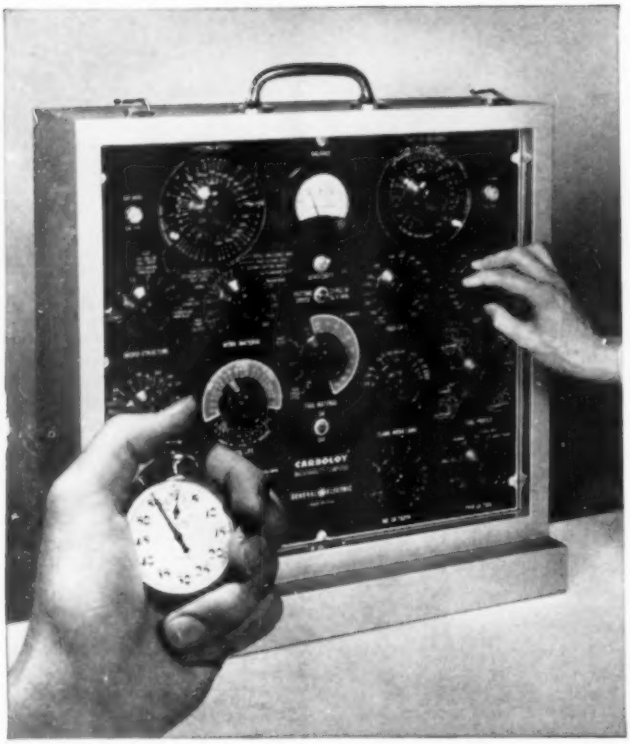
Preliminary reports show Cemented Oxide can also improve efficiency of relatively low-speed equipment. Because this material provides longer tool life at higher speeds, output increases and cutting time is reduced.

Takes up where carbides leave off

Carboloy Cemented Oxide is not a typical ceramic or cermet. It is stronger and more resistant to chipping than typical ceramics. Four years in development, Cemented Oxide takes up where carbides leave off on high-speed steel finishing.

To aid full-scale commercial evaluation of Carboloy Cemented Oxide, a limited number of sizes and shapes will be available January 1. For the preliminary technical bulletin, send the coupon on page 8 of this advertisement.

CARBOLOY
DEPARTMENT OF GENERAL ELECTRIC COMPANY



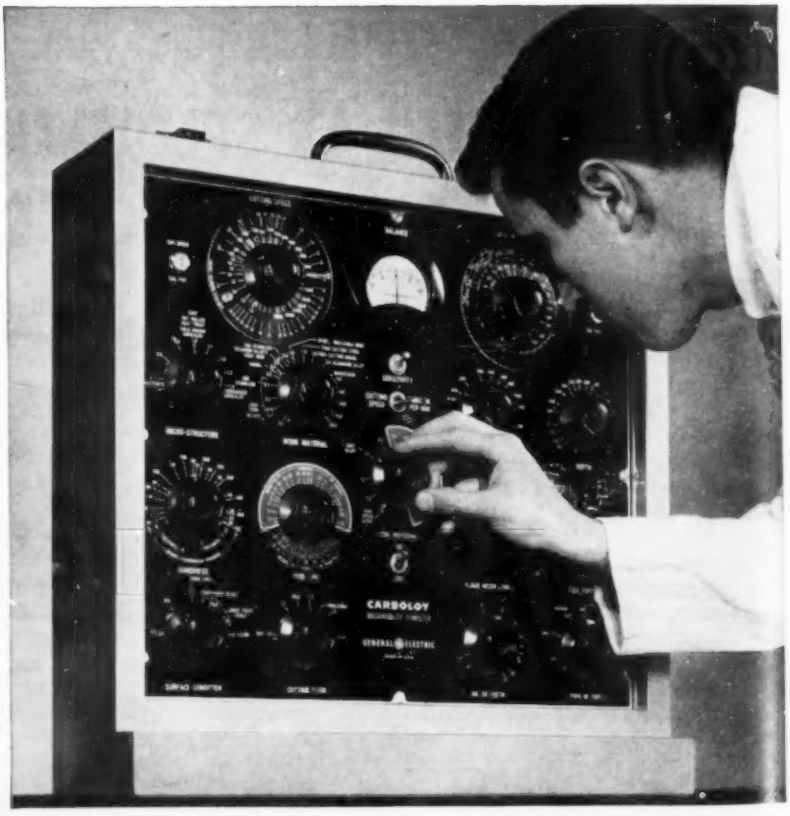
SOLVE MACHINING PROBLEMS IN SECONDS

The Carboloy Machinability Computer can determine the most efficient values for any of these 19 basic operating variables:

Material to be cut: Work material, microstructure, hardness, surface condition.

Cutting tool: Tool material, tool life, flank wear land, tool profile, type of tool, number of teeth.

Cutting conditions: Cutting fluids, feed, depth of cut, cutting speed, motor horsepower, cubic inches per minute, unit horsepower, work diameter, R.P.M.



Set dials for the values of each of the known variables. (Time: 1 – 2 minutes.)

Turn dial of unknown variable until meter balances at zero setting. (Time: 10 – 15 secs.)

Read the answer directly off the dial. No computations are necessary. (Time: 10 secs.)

WITH CARBOLOY MACHINABILITY COMPUTER

- **Calculate production, tool life, horsepower, or any of 16 other basic machining variables**
- **Eliminate wasteful tryout runs, improve existing setups**

The Carboloy Machinability Computer is a new engineering tool designed to solve complex machine setup problems in seconds, instead of hours.

It calculates the effect of the 19 most critical machining variables on the material to be cut, the cutting tool, and the cutting conditions . . . shows how to set up optimum operating conditions for any metal-cutting job, and how to improve existing setups by the right variation of operating conditions.

For production men, methods men, etc.

The Computer assists production men by determining rate of metal removal, and by immediately showing how production is affected by changes in feed, speed, depth of cut, tool material, and other key variables.

The Computer eliminates wasteful, nonproductive trial runs, saving valuable stock and setup time. It also determines machine output for methods men, pieces per hour for estimators, and it answers other problems pertaining to machining . . . providing accurate solutions in seconds for problems that normally take hours for even approximate answers.

Easy to use

The Carboloy Machinability Computer is easy to operate. Anyone with machining experience can use it after a short familiarization period.

The computer is portable (weighs only 32 lbs.), battery-operated, and measures 21″ x 7″ x 20″. The price of the computer is $495, f.o.b. factory, Detroit.

Whether your plant is large or small, the Carboloy Machinability Computer can pay for itself by increasing production, reducing manpower costs. Send the coupon on page 8 of this advertisement for full details. If you request it, we will arrange a demonstration in your plant.

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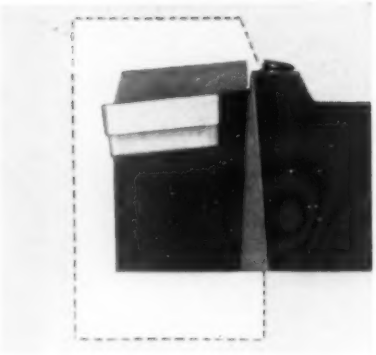


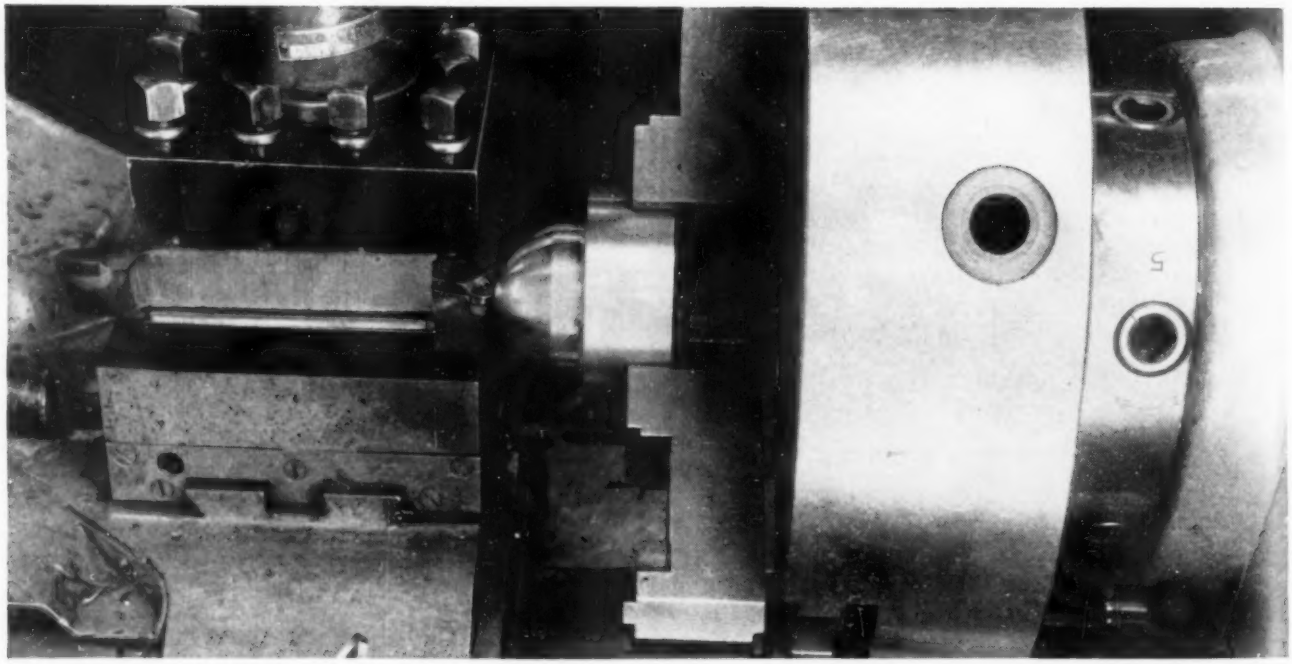
New design eliminates "club" below shank; reduces overhang to absolute minimum. Indexing is fast, simple . . . accuracy is increased.

Clamp has built-in, wear-resistant carbide chipbreaker. Requires only light finger pressure to tighten; assures uniform chips on any cut.

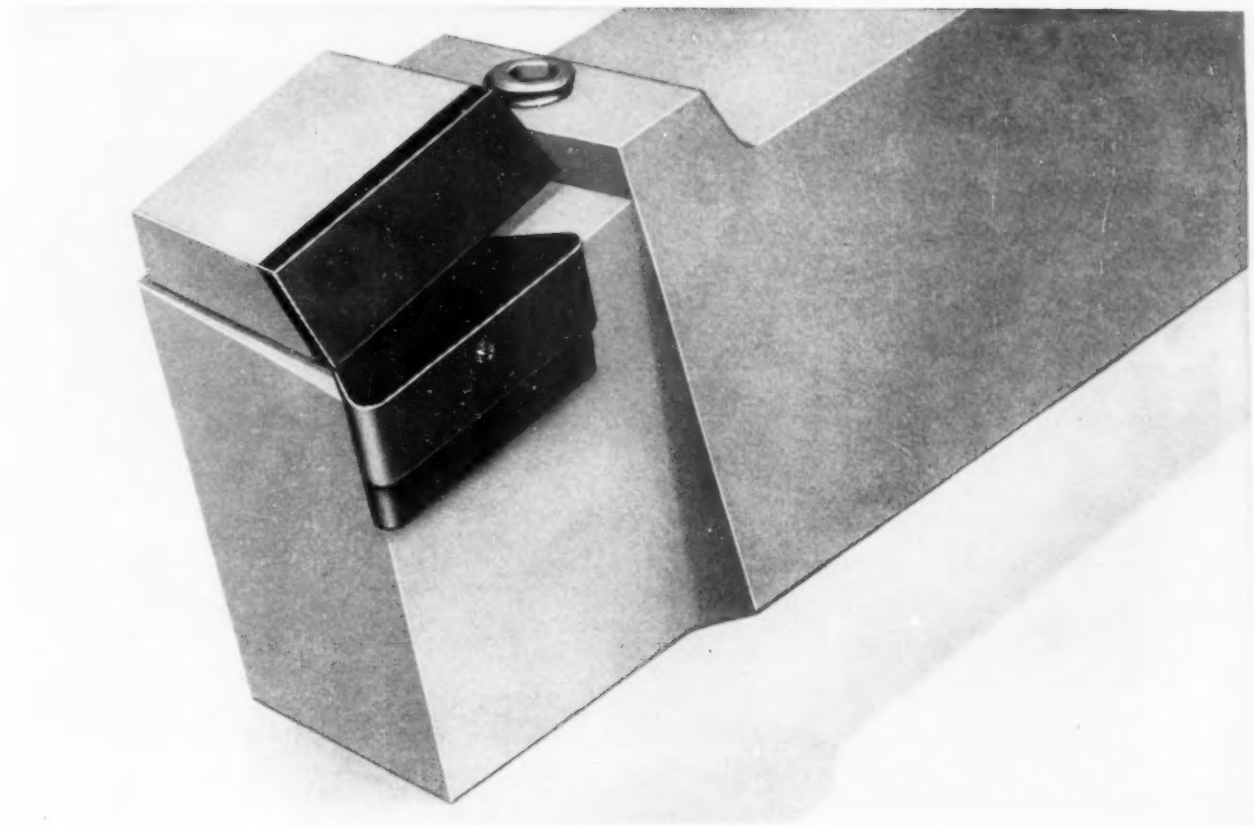
Indexable carbide pad is screwed to shank. Stays put while blank is indexed. Absorbs shock; decreases the possibility of holder damage.

because they combine four
basic design improvements . . .

NEW CARBOLOY TOOLHOLDERS ARE EASIER



Contouring Stellite valve. Round Carboloy cemented carbide insert is furnished precision-ground, eliminating costly grinding operation required for braze-type tools. Inserts on new Carboloy toolholder are indexed or turned over right in the machine . . . reducing downtime. With Carboloy holders, only inserts are stocked . . . saving valuable toolroom space.



TO USE . . . STRONG, SIMPLE, AND ACCURATE

- **Single screw indexes insert; automatically sets chipbreaker**
- **Carbide pad absorbs shocks; cuts throw-away insert costs**
- **New design reduces overhang; improves tool accuracy**
- **Heat-treated shanks resist bending and deformation**

Simply adjust a single screw at the top of the shank, and the cutting blank can be indexed or turned over while the Carboloy holder stays in the machine. The carbide chipbreaker is set automatically in the correct position.

Carbide pad cuts insert costs

Because the carbide pad absorbs shocks and gives greater rigidity, thinner, harder, more economical cutting blanks can be used. Machines operate at greater speeds and feeds; increase output at reduced cost.

Carboloy design eliminates projections below the shank . . . reduces overhang, increases accuracy and rigidity. Minimum projection above the shank stops chip interference, protects clamp from abrasive chips.

Heat-treated shanks give the holders extra strength to resist clamp-screw deformation and chip wear.

Handle special jobs with ease

The Carboloy holder design is quickly adaptable to "specials" with cutting angles other than standard, and to positive or neutral rakes. New, compact design makes them especially efficient for gang tooling.

Available for round, square, or triangular blanks, the Carboloy holders are stocked in seven styles and 52 sizes. New, heavy-duty holders are also available. For prices and specifications, send in the coupon on page 8 of this advertisement.

CARBOLOY
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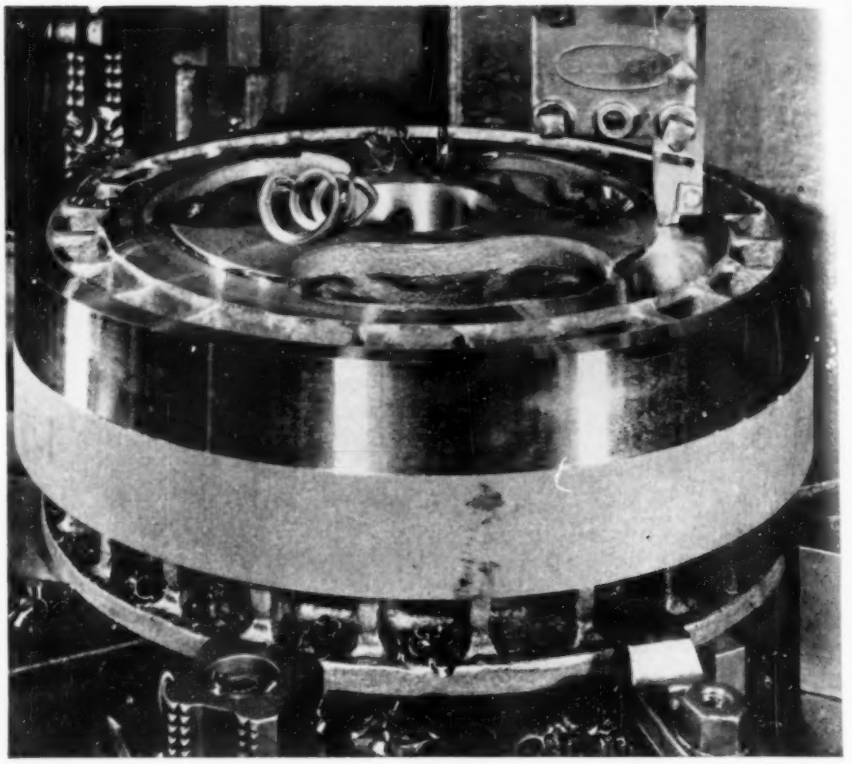
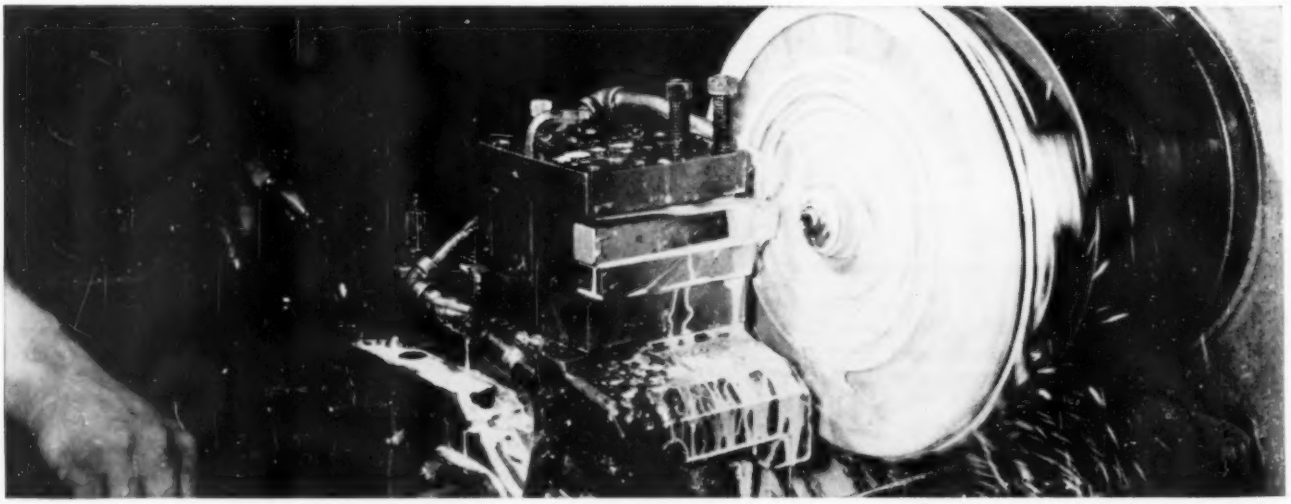


FACING POWER-SHOVEL CLUTCH AND BRAKE DRUM. It took as many as 16 of the former carbide tools, on a 42-inch Bullard, to make a *single* cut through multiple sand inclusions and heavy interruptions. A Grade 370 tool took *nine* cuts without any appreciable wear. Because the Grade 370 tool outlasted 144 of the previous tools, over-all machining costs were cut almost 70%, downtime costs were reduced from $60 to $1, and grinding was completely eliminated.

SETUP: Material—1045 low carbon, high manganese cast steel, with hardness of 27 R_c. **Speed**—24 RPM. **Feed**—0.018-0.033 inch. **Depth of cut**—⅜ inch. **Coolant**—No.

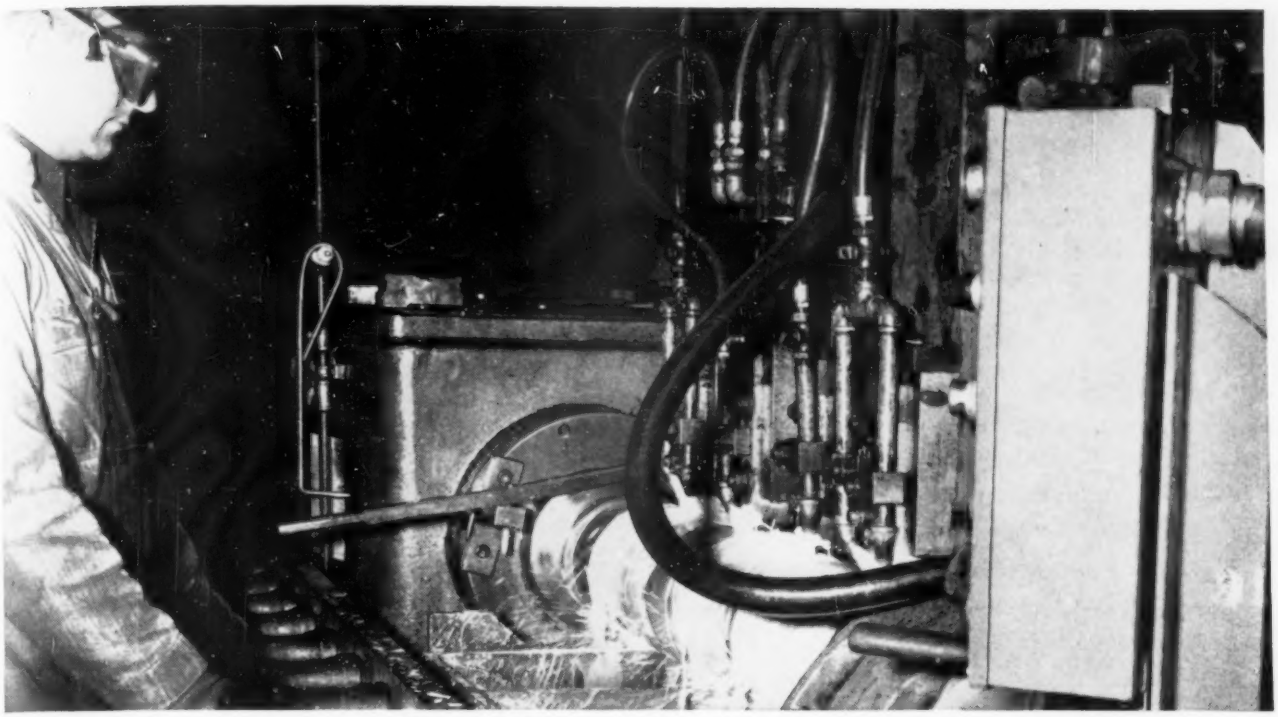
Hundreds of in-plant case histories prove . . .

CARBOLOY GRADES 350 AND 370 CUT FASTER,



FACING TURBINE WHEEL BUCKET. It took 60 carbide tools, making two separate cuts, to get daily production of 25 units at Kelsey-Hayes Wheel Co. By switching to Grade 370, the two-cut operation was compressed into one, the number of tools required was reduced two thirds, and production was almost doubled.

SETUP: Material—Inconel, heat-treated to 18 R_c, welded to rim of Stellite. **Speed**—125 sfpm. **Feed**—0.0155 inch. **Depth of cut**—⅜ inch. **Coolant**—Yes.



TURNING 8-INCH STEEL SHELL. Grade 350 increased production runs on these forged and extruded shells between 15 and 20 pieces per grind. At toughest stage of rough-turning operation, Grade 350 processed 4 times as many shells as other carbides.

SETUP: Material – 1045 steel with varying heat analysis. **Speed** – 302 sfpm. **Feed** – 0.044 inch. **Depth of cut** – 3/16 to 7/16 inch. **Coolant** – No.

WEAR LONGER, GREATLY INCREASE OUTPUT

- **Outperform all other steel-cutting carbides**
- **Take heavier, deeper cuts without deformation**

The machining records in plant after plant show Carboloy Grades 350 and 370 are capable of increasing output up to 300% over previous carbides used.

Not only do these grades outperform conventional carbides at higher speeds and feeds, but they outwear them on the toughest jobs – in some instances by margins as high as 144 to 1. (See case history above at left.)

Built-in structural rigidity

Carboloy Grades 350 and 370 are extra-performance carbides. Their superiority is due to the greater structural rigidity built-in by the Carboloy manufacturing process.

This process enables them to take deep, punishing cuts without the chipping, cracking, or cratering encountered in other carbides . . . even at temperatures as high as 1800° F.

No "equivalent grades"

Try heavy-duty Grade 370 and medium-duty Grade 350 in your own plant . . . compare them with regular tools on your toughest jobs. You'll quickly see why there are no "equivalent grades" to Carboloy 350 and 370.

Your local Authorized Carboloy Distributor stocks a complete line of Grade 350 and 370 tools, blanks, and inserts. Contact him today; or for more information on these extra-performance carbides, send in the coupon on page 8 of this advertisement.

CARBOLOY
DEPARTMENT OF GENERAL ELECTRIC COMPANY

Fill all your tooling needs
from a single, local source . . .

135 AUTHORIZED DISTRIBUTORS STOCK COMPLETE CARBOLOY LINE

Whether you're machining steel, cast iron, nonferrous metals, or plastics, you can depend on immediate delivery of the tools, blanks, and holders you need from your local Authorized Carboloy Distributor.

When you use your Carboloy Distributor's stocks as your own, you'll put valuable stockroom space to more advantageous use. When you order from a single, local source, you'll save on inventory and bookkeeping costs.

And call in your Distributor on machining problems. He is specially trained at the Carboloy factory to recommend the best carbide grade and tooling system for the job.

For the name of your local Authorized Carboloy Distributor, see the Yellow Pages of your phone book. He's listed under the Carboloy trademark heading in the "TOOLS" or "TOOLMAKERS" classification. Or, write to us for the name and address of the distributor in your area.

For more information on the Carboloy products described on the preceding pages, send the coupon today.

Carboloy Distributors provide immediate delivery on all standard Carboloy tools, blanks, inserts, and toolholders.

CARBOLOY
DEPARTMENT OF GENERAL ELECTRIC COMPANY
11101 E. 8 Mile Street, Detroit 32, Michigan

Send me information on the following Carboloy products:

- ☐ Carboloy Cemented Oxides (preliminary data)
- ☐ Carboloy Machinability Computer
- ☐ Have a representative call to demonstrate the Computer
- ☐ Carboloy Toolholders
- ☐ Grades 350 and 370 steel-cutting carbides
- ☐ Send me the name of the nearest Authorized Carboloy Distributor

Name_____

Title_____

Company_____

Address_____

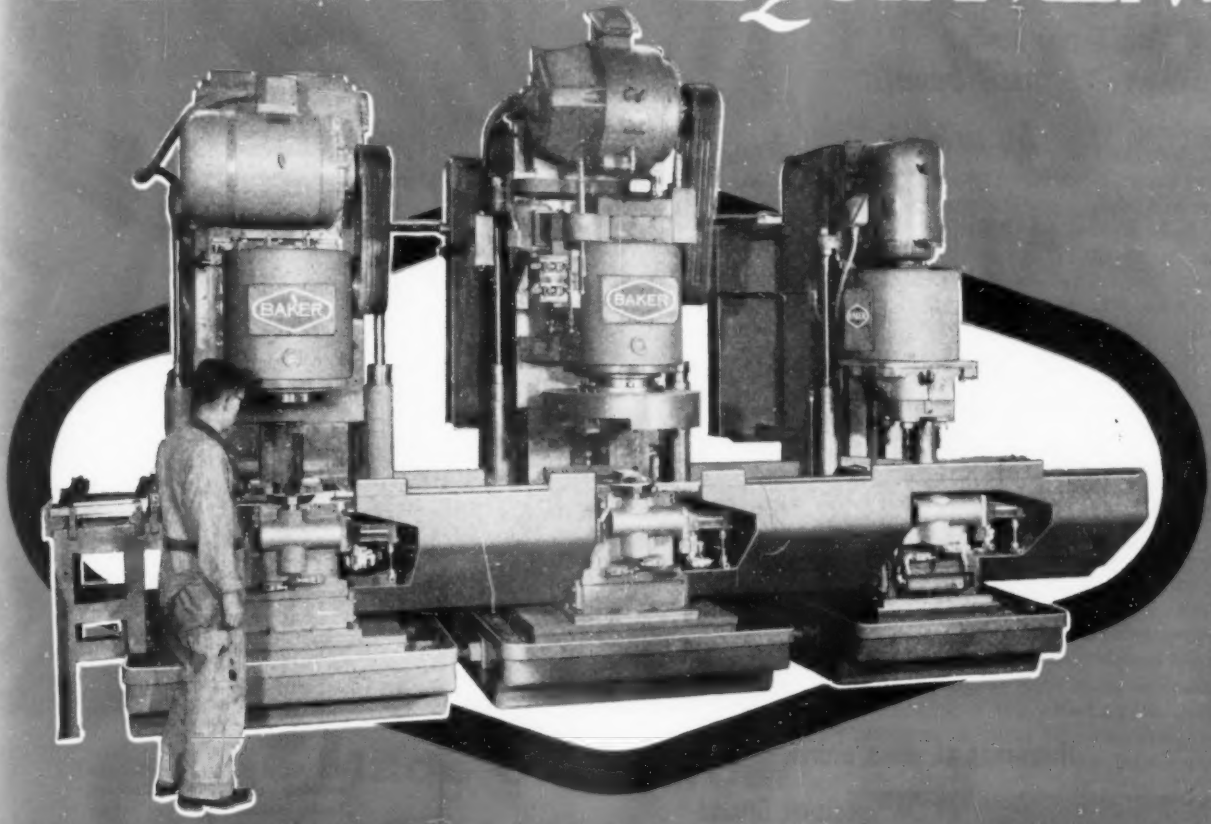
City_____ Zone____ State_____

"Carboloy" is the trademark for products of the Carboloy Department of General Electric Company

Carboloy Created-Metals for Industrial Progress

The Average Shop Needs and Now Can Afford

AUTOMATIC EQUIPMENT



The new three standard unit Baker Machine introduced at the show, is combined to operate as a transfer machine, set up with a low cost, simplified fixture, proving the possibility of providing automatic machines through use of STANDARD MACHINES . . . And thereby achieving automation without tremendous expenditure. Operations on the new Baker Transfer are Combination Bore & Counterbore . . . Face (cross feed) . . . and Multiple Drill . . . All Automatically. Write regarding your specific job problems.

BAKER

Standard and Special
Drilling . . . Boring . . . Tapping
Keyseating and Contour Grinding Machines

BAKER BROTHERS, INC.

TOLEDO 10, OHIO

You too...

will benefit by using

ATRAX CARBIDE TOOLS

Thousands of users everywhere continue to specify ATRAX Precision Ground-from-the-Solid Carbide Tools.

Whether your needs are for Carbide Burs, Drills, Reamers, Tool Bits, End Mills, Special Cutters—either Stock Items or Specials—you'll be amazed at the superior cutting edges, longer life, better production results with ATRAX.

It's New! Complete 88-page catalog of ATRAX Carbide Tools, includes selection tables and recommended applications. Write today for your copy.

THE ATRAX COMPANY
NEWINGTON 11, CONNECTICUT

Specify ATRAX Precision Ground-from-the-Solid Carbide Tools

ATRAX Representatives and Distributors are located in principal cities throughout United States and Canada. Write us for our Representative's name in your area.

Tool Steel Topics

BETHLEHEM STEEL

Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

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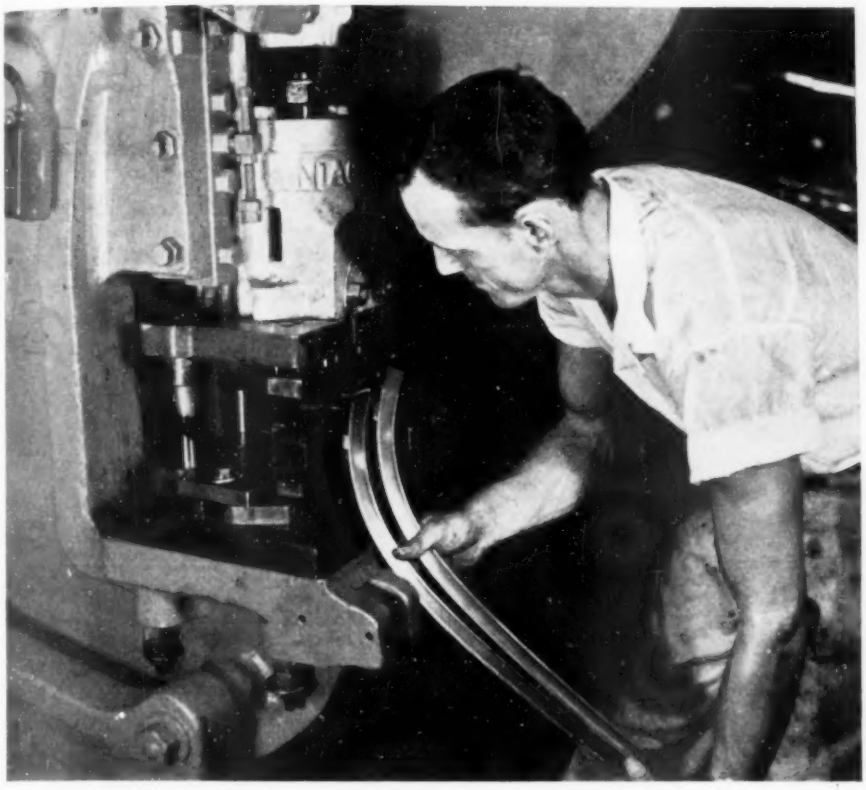


Notching Die Made of Bearcat Gives 7 Times Greater Output

An interesting item being manufactured in the southeastern part of the country is a windshield garnish molding for a popular make of automobile. The molding is produced from cold-rolled steel, 0.020 in. thick. It is formed by a notching die, hardened to Rockwell C 56-58.

With the grades of shock-resisting tool steel formerly used for the die, a maximum of 1400 pieces was produced before breakage occurred. Because of the severity of the application, this was considered good production even though it necessitated a change of die about five times daily.

After studying the operation, we suggested a change to Bearcat tool steel. "Bearcat is a super shock-resisting grade," we said. "We're sure it will last longer in a tough job like this, and so save you money. Why don't you give it a try?"

So Bearcat was put to work. The dies made of Bearcat have been giving a good account of themselves by producing up to 10,000 pieces before being replaced. That's seven times the output obtained from the dies before changing to Bearcat.

Surprising? Not at all. Bearcat is continually chalking up new performance records in a variety of interesting applications. Bearcat is a superior, general-purpose grade of air-hardening tool steel. It has exceptional resistance to shock, and is also well suited for uses where hot-work properties and easy machining are essential. Bearcat can be used in a wide range of applications such as punches, master hobs, engraving dies, and short-run dies used in cold-forming, blanking and bending.

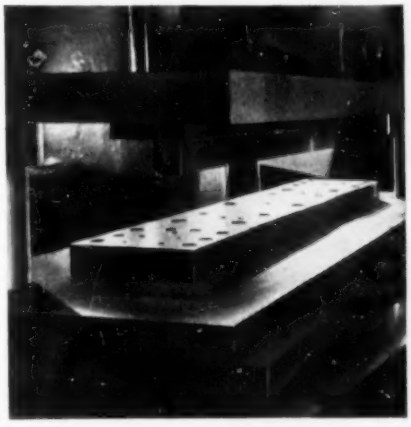
The best way to determine how good a job Bearcat can do is to put it to work on some difficult job in your shop. You can order Bearcat through your local Bethlehem tool-steel distributor. We also carry it in stock in our mill depot.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Retemper Tools After Grinding

No matter how carefully performed, grinding operations on hardened tools always generate residual stresses in the tools. But as tools already contain residual stresses after they are quenched, any additional stresses are likely to cause trouble. Now, if the combined stresses are sufficiently high, cracking may occur during grinding, which makes it easy to locate the source of the trouble. But if the combined residual stresses are just below the ultimate strength of the steel, cracks will not appear for the time being. Instead, the tools are apt to crack subsequently, at the application of normal stresses set up either in handling, or in using the tools.

To avoid this difficulty, we recommend reducing the stresses to a safe level by retempering the tools immediately after grinding, using a temperature which is slightly lower than the original tempering temperature. With many toolmakers, retempering after grinding is routine procedure, a form of insurance, more or less, against running into trouble.



BLANKING DIE FOR HANDBAG HANDLES

This blanking die, used by Westberg Tool and Manufacturing Company, Bridgeport, Conn., for the manufacture of handbag handles, has BTR (Bethlehem Tool Room) tool steel in both the die and the punch. BTR is our long-wearing, general-purpose, manganese-chromium-tungsten grade of oil-hardening tool steel.

BAY STATE TAPS

WHEREVER YOU ARE

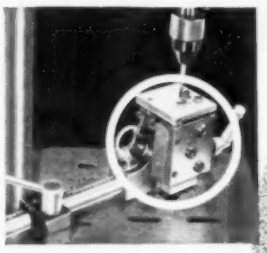
. . . when you need Bay State Precision Performance Taps, *call your Industrial Supply Distributor.* He'll deliver them with supersonic speed to keep your production high . . . and he'll stock the sizes you need to keep your inventory and tapping costs low.

BAY STATE TAP & DIE COMPANY

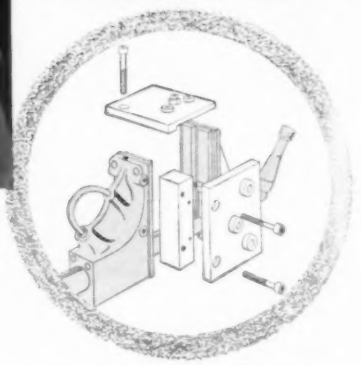
MANSFIELD, MASSACHUSETTS

USE READER SERVICE CARD; INDICATE A-12-216-1

Cut Drill Jig Costs $150 to $800



Two side plates added to jaw of $35 vise form perfect 2-plane drill jig. Heavy jaw face models also available to permit dowelling for precision tolerances.



AMF FLOAT-LOCK instant-change drill press vise eliminates need for up to 80% of drill jig parts.

One- or two-plane jigs are yours quickly, inexpensively with this versatile vise that sets left, right or vertical.

Jig attachments are easy because of bosses on quick-positioning, ratchet-locking jaw.

Positive anchoring eliminates time-wasting clamps, bolts and washers . . . prevents work from flying off the table!

Finger-tip control of handle causes positive, screw actuated jaw to grip firmly or release work up to 12" without effort.

Call your distributor for a demonstration of the AMF Float-Lock Vise. Or, *write for* **Free 14-page folder,** W-50. Wahlstrom/Float-Lock Div., Room 60, American Machine & Foundry Co., 261 Madison Ave., New York 16, N.Y.

Another AMF Product

Float-LOCK

SAFETY VISES

USE READER SERVICE CARD; INDICATE A-12-216-2

GEORGE L. Detterbeck Quality Tools

SPEED UP Screw Machine Production

SELECT YOUR NEEDS FROM THIS LIST

We specialize in

- CUTTING CAMS
- HIGH SPEED STEEL AND CARBIDE FORM TOOLS
- SPECIAL CUTTING TOOLS
- SPLIT DRILL BUSHINGS
- CROSS SLIDE KNURL HOLDERS
- TOOL BITS
- BOX TOOLS
- BURNISHING TOOLS
- REVOLVING STOPS
- RECESS SWING TOOLS
- FORMING SWING TOOLS

We manufacture cams and tools for the trade on a production basis. As a result we offer:

1. Superior type tools . . . at low cost.
2. Practical design accuracy.
3. Correct specifications which insure maximum service.

Your tool requirements in our hands is your guarantee of better tools at a great saving.

PROMPT DELIVERIES

Tool making with us is a routine matter. Special equipment . . . skilled hands . . . plus know how, enables us to fill orders in a minimum of time.

SERVICE

Let us quote on your tool requirements. You'll save money . . . even as compared with "home made" tools.

Standard circular form tools for B&S and Davenport Machines carried in stock. Immediate delivery.

Established 1911

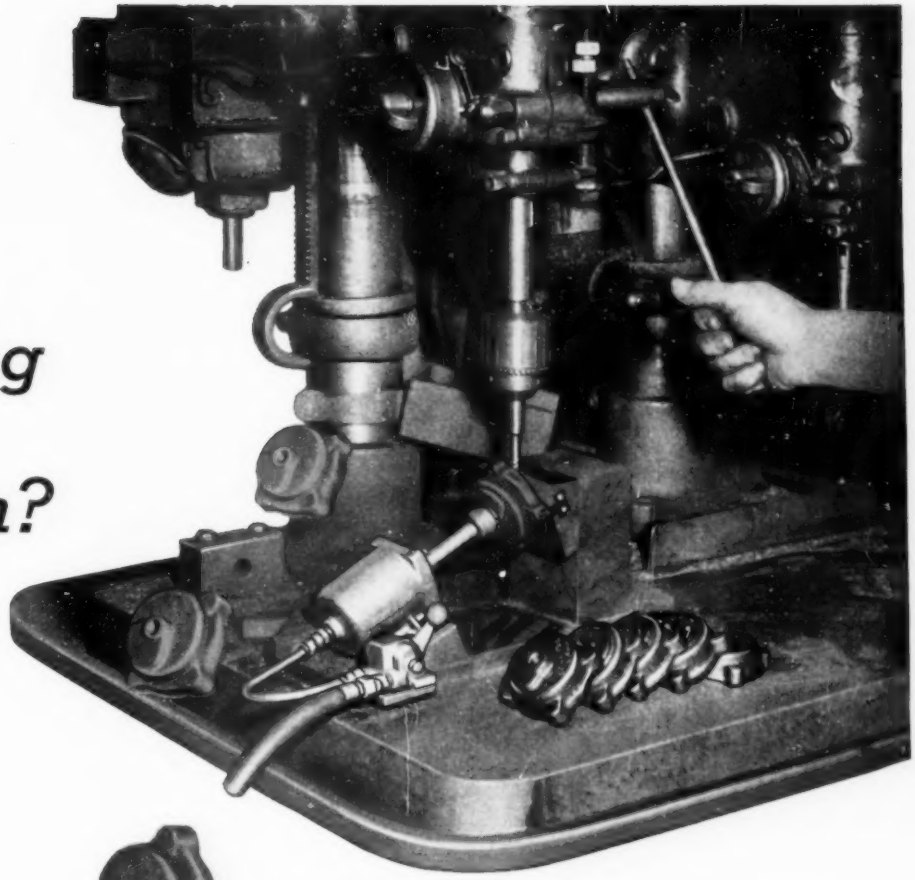
44 years at the same address.
Our service is nation-wide.
We have no branch factories.

GEORGE L. DETTERBECK CO., Incorporated. 1871 Clybourn Ave., Chicago 14, Ill.

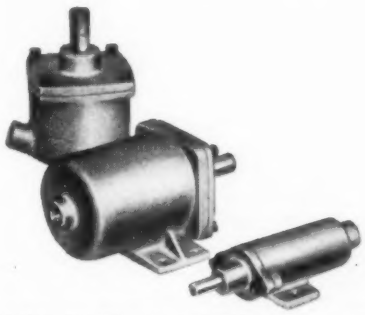
ENGINEERS TO AN INDUSTRY

USE READER SERVICE CARD; INDICATE A-12-216-3

Clamping Problem?



SCHRADER has the answer!



Schrader Air Clamping Cylinders are available either base or leg mounted, in 1", 2¼" and 3" diameters delivering a 2" or 1" stroke. A wide selection of Schrader Valves is available to operate this equipment.

Schrader

REG. U. S. PAT. OFF.

Leaders in air control since 1844

The **Schrader Air Clamping Cylinder** is actually a bantam air cylinder that can *add several minutes* to each worker's production hour . . . eliminate the need for slow, manual clamps.

Think of all the clamping operations in your own shop. Milling machines . . . drill presses . . . power presses . . . welders . . . gluers – and many dozens of other machines that are now idling for ten or fifteen seconds while operators go through slow clamping operations. Why not save time – and operator annoyance – with fast, convenient Schrader Clamping Cylinders, as so many other industrial plants have already done? Remember, you can mount these Schrader Clamping Cylinders anywhere – and actuate them automatically or manually.

For full details on the models available – or any of the hundreds of air control products in the complete Schrader Line – write today. Or, if you prefer, fill out the coupon below.

A. SCHRADER'S SON
Division of Scovill Manufacturing Company, Incorporated
462 Vanderbilt Avenue, Dept. E-12, Brooklyn, N. Y.

I am interested in more information on _____

Name _____ Title _____

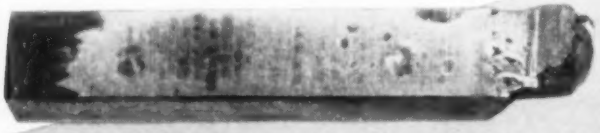
Company _____

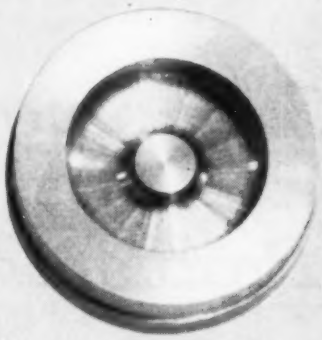
Address _____

Mallory *No-Chat** Shanks

can multiply tool life

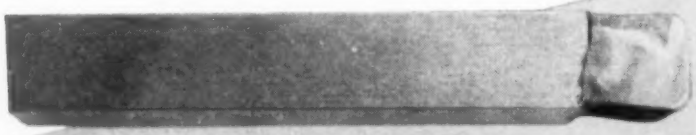
Worn out after 6 pieces,
this carbide tip on a conventional steel shank quickly broke down when form-cutting a hard tungsten alloy. Depth of cut—0.188".

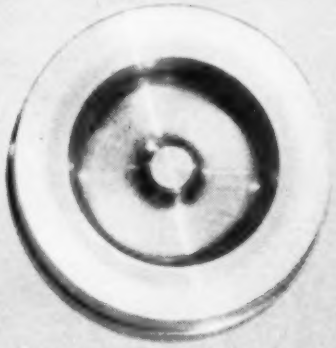




Compare these unretouched photographs

Still good after 2000 pieces
on the same job is this carbide tip brazed to a Mallory *No-Chat* shank. Cuts are much smoother; surface finish is 18-25 microinches RMS.





TOOL CHATTER when cutting hard materials, operating at high surface speeds, or taking heavy cuts at long overhang can be greatly reduced by the use of Mallory *No-Chat* shanks and boring bars. The secret of this unusual performance is the unusual physical characteristics of the *No-Chat* Alloy. A product of Mallory metallurgical research, this unique material has *twice the density* and *75% more rigidity* than cold-rolled steel.

No-Chat dampens out tool vibration at the source . . . giving you longer life, smoother machined surfaces, longer runs between grinds. It lets you make cuts into long, deep bores without resorting to oversize shanks or special fixtures.

No-Chat shanks are re-usable. New tips are readily brazed in place. The material does not anneal, and grain growth is no problem.

Square and round *No-Chat* stock is available in a variety of sizes suitable for lathe, planer, boring and shaper tools. Write to Mallory today for technical facts . . . and for a consultation by a Mallory specialist on your specific tool problem.

**Trade Mark*
Patent Applied For

***Expect more . . . Get more from* MALLORY**

In Canada, made and sold by Johnson Matthey & Mallory, Ltd., 110 Industry Street, Toronto 15, Ontario

P. R. MALLORY & CO. Inc.
MALLORY
P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

Serving Industry with These Products:
Electromechanical—Resistors • Switches • Television Tuners • Vibrators
Electrochemical—Capacitors • Rectifiers • Mercury Batteries
Metallurgical—Contacts • Special Metals and Ceramics • Welding Materials

For information on titanium developments, contact Mallory-Sharon Titanium Corp., Niles, Ohio

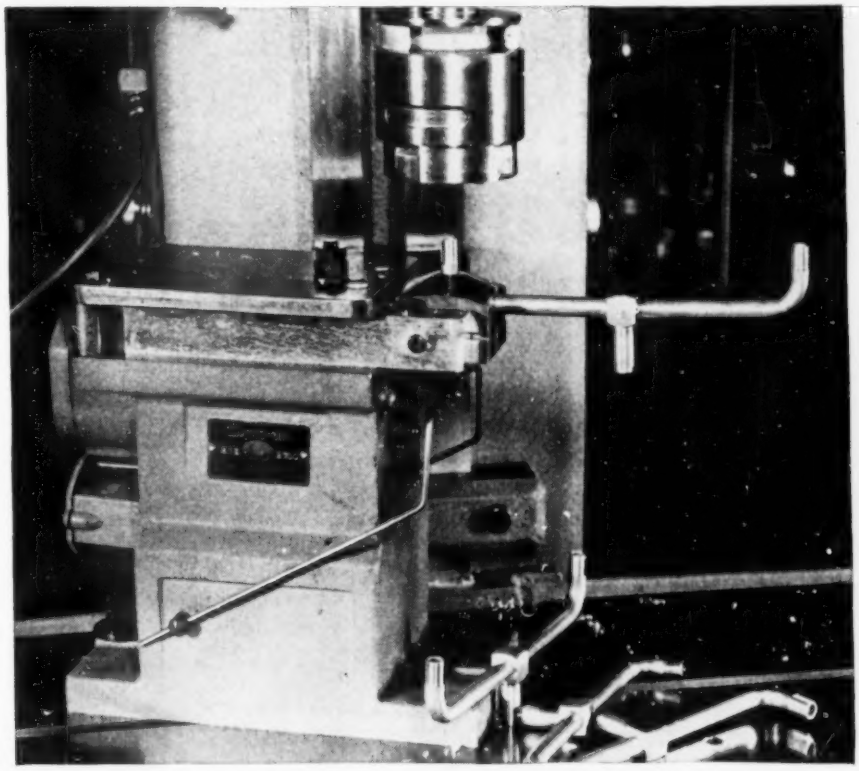
Quicker changeover, lower tooling costs...

with SNOW FULL UNIVERSAL MACHINES

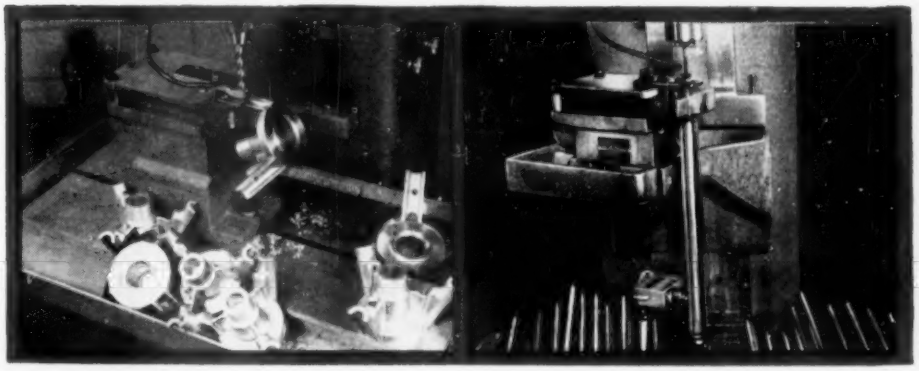
ELECTRICALLY OPERATED AIR CONTROLLED AUTOMATIC OR SEMI-AUTOMATIC

Basic Master Fixtures for DRILLING, THREADING or TAPPING. Snow universal machines are the most flexible, most efficient, and most economical known. They save countless dollars in changeover time — help you start jobs sooner — assure quality at high production rates.

The square footage under a Snow Machine in your factory can be the most profitable in your whole plant. Submit details of your requirements.



AIR VISE holds part firmly — self-centering — always in exact position for precision work. U-shaped wire underneath provides quick finger-tip control, automatically starting spindle cycle. Jaw inserts keep tooling costs at minimum. Blank jaws always in stock — can be tooled to fit your part promptly, inexpensively.



Irregularly shaped parts are easily handled. Front feed permits close setting of guide plate for greater accuracy with high production.

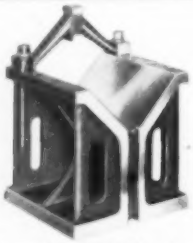
Here a short AIR VISE mounted on an offset table holds long tubing. Piece-part switch under table automatically closes vise and starts tapping operation.

SNOW MANUFACTURING CO., BELLWOOD, ILL.
(Suburb of Chicago)

For Fast Accurate Setups

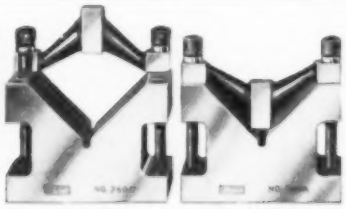
These Taft-Peirce Specialties are a 'must' for machining and inspection in the toolroom

V-BLOCKS



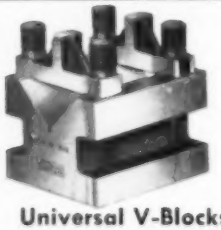
Cast Iron V-Blocks

Accurately ground to size in pairs. Made from finest quality seasoned grey iron castings. All surfaces except top are square or parallel with each other within .0005".



Steel V-Blocks

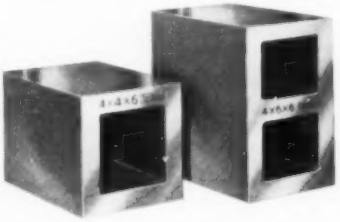
Sold in pairs only. Made of alloy steel, hardened and ground. "V" is central with sides, parallel with bottom, square with ends within .0003". All surfaces square or parallel within .0002".



Universal V-Blocks

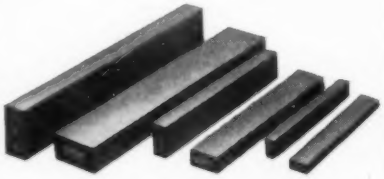
Hole in center permits quick, accurate setups. Also provides clearance for tool in drilling and boring. Made of alloy steel, hardened and ground on all working surfaces. All sides square within .0001". Sold singly or in pairs.

PARALLELS



Box Parallels

Made of finest quality close grained cast iron. All sizes are parallel within .00025" in 6 inches, square within .0005" in 6 inches. Will pair up within these limits.



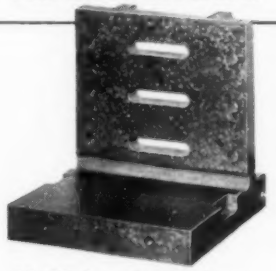
Steel Parallels

Made of alloy steel, hardened and ground on four sides. Exceptionally durable and free from seasonal changes. Not made to be used as squares.

Planer and Boring Mill Parallels

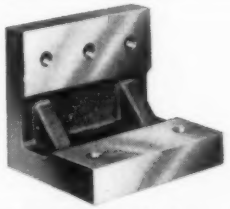
Made of finest quality cast iron. Width and thickness held within plus or minus .0005". Square within .0005" in 6 inches. Parallel within .0005" in total length.

ANGLE IRONS



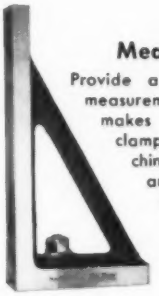
Multiplex Angle Irons

Save time by permitting a single setup of workpiece for many machining and inspection operations. All working surfaces scraped square within .0005" in 6", parallel within .0005".



Duplex Angle Irons

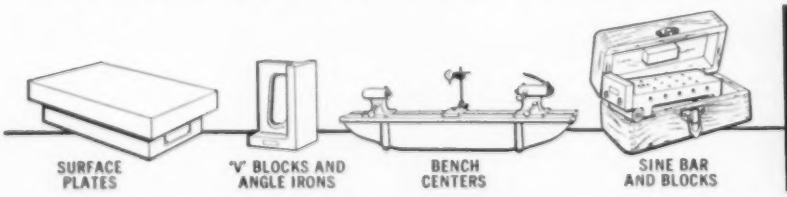
Finished inner pads increase accuracy, speed setup work and usually eliminate need for table clamping. Inner pads parallel to sides within .0005". Outer faces square within .0005" in 6".



Measuring Irons

Provide a fixed surface for measurements. Narrow width makes it convenient for clamping work on the machine table. Front face and bottom finished square within .0002" per foot.

For the complete story on these items and many more send for your copy of the Taft-Peirce Handbook.



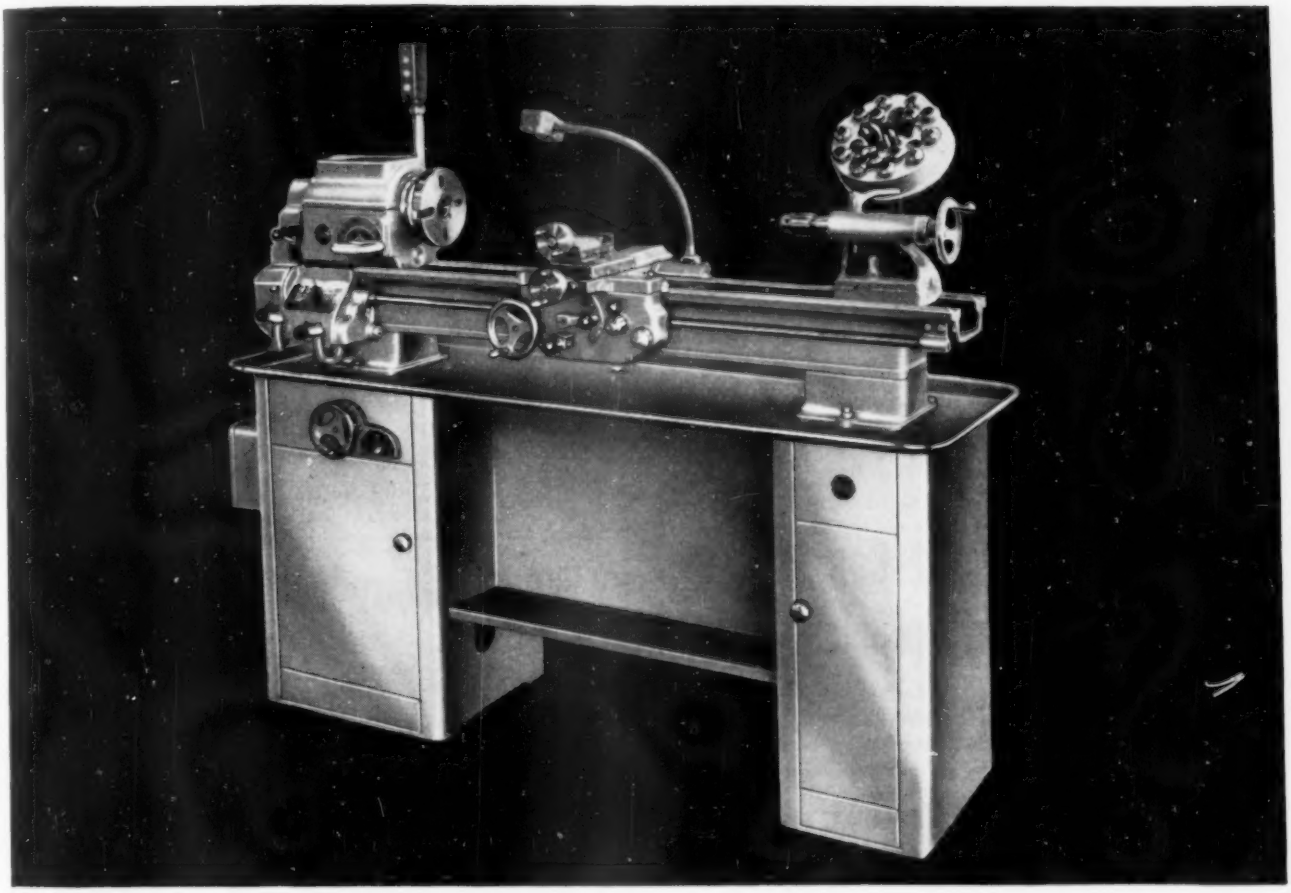
T-P means Top Precision

T P

THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, RHODE ISLAND

ROCKWELL-BUILT

now, a great new long-bed DELTA 11" metal cutting lathe



. . . new, big capacity 5-foot bed—plus all the exclusive Delta quality features that have gained industry-wide acceptance for the standard model.

. . . designed for production work as well as tool rooms and experimental shops—lets you handle many production jobs that normally would require far more expensive machines.

. . . combines real precision for close control, with extra ruggedness for heavy duty service—all at a price so low it's almost unbelievable!

See it! Compare it! Get all the facts about it! Then—make up your own mind! Your Delta Dealer is listed under "TOOLS" in the classified pages of your phone book. Send the coupon for complete details—today!

Send Coupon for all the facts!

Delta Power Tool Division, Rockwell Manufacturing Co.
620 M North Lexington Avenue, Pittsburgh 8, Pa.

☐ Please send name of my nearest Delta Dealer.
☐ Please send Delta AB Catalog on the new long-bed Delta 11" metal lathe.

Name _____ Title _____

Company _____

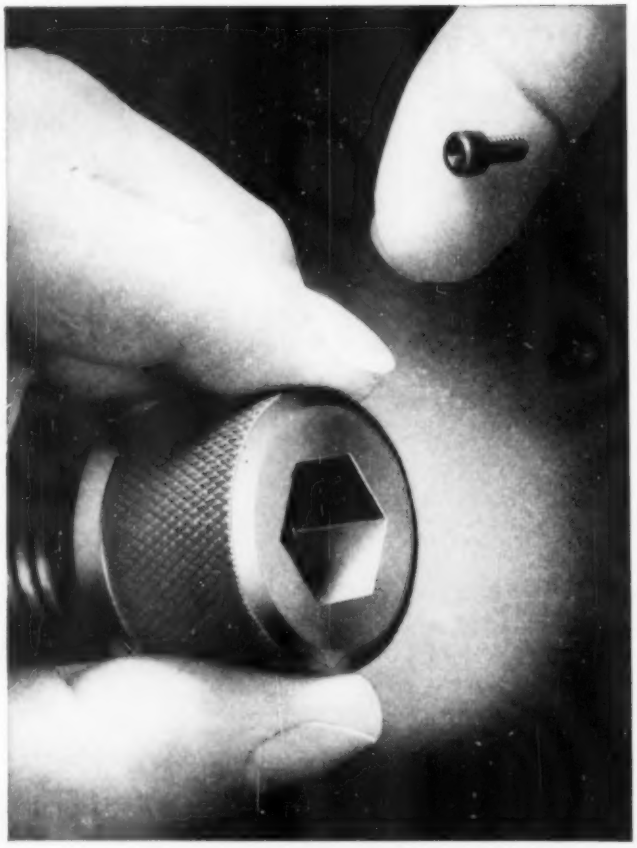
Address _____

City _____ County _____ State _____

DELTA ROCKWELL **DELTA** QUALITY POWER TOOLS

Another Product by **Rockwell**

DELTA QUALITY COSTS NO MORE



Sizes from 1½ inch to No. 0 wire size.

Bristol Hex Socket Cap Screws mark your product "precision made"

The high quality and pleasing appearance of Bristol's Hex Socket Cap Screws will reflect the precision you've built into your product.

Perfectly squared-up heads and shoulders of these screws give them a smooth, accurate, and well-designed look. Their diamond-knurled heads make them easier to insert, to start and to spin up finger-tight. And, of course, they can be internally wrenched up permanently tight.

We've made precision instruments at Bristol for 66 years and socket screws for more than 42. In fact, we originated the famous Bristol Multiple-Spline Socket Screw. That's why we know Bristol Hex Socket Cap Screws can meet your design or assembly needs exactly.

Standard Bristol's Hex Socket Cap Screws conform to Class 3A fit. They're standard in stainless steel and heat-treated special alloy steel.

Write today for descriptive literature and samples.

A.5.7

LARGE AND SMALL—WE MAKE THEM ALL

Standard in sizes as small as No. 0 in Alloy Steel and Stainless Steel.

THE BRISTOL COMPANY, Socket Screw Division, Waterbury 20, Conn.

USE READER SERVICE CARD; INDICATE A-12-222-1

WORLD'S HARDEST METAL

BUSHINGS
BLADES
ROLLS
TOOLS
DIES
BAR STOCK
IMPROVED QUALITY
Additional refinements and improvements in our process have added still longer life to the wearing edges of Talide tools, dies and wear resistant parts. The result is a carbide having a new, unique grain structure with harder and tougher properties than previous grades. Laboratory tests reveal our improved grades possess 25% greater strength and rigidity. Service life per grind up to 50% longer than previous grades has been proven in grueling field tests.
METAL CARBIDES CORP., YOUNGSTOWN 7, OHIO
Write for Catalog 55-G
METAL CARBIDES CORPORATION
TALIDE
YOUNGSTOWN 7, OHIO
HOT PRESSED AND SINTERED CARBIDES · VACUUM METALS
HEAVY METAL · CERMETS · HIGH TEMPERATURE ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

USE READER SERVICE CARD; INDICATE A-12-222-2

high-speed automatic marking machine MATTHEWS 201

Increase your production capacity with a motorized Rotary Marking Machine that marks around conical or cylindrical parts up to 3" in diameter—at rates up to 7,200 parts per hour!

Equipped with automatic feeding and ejection mechanism; the "201" becomes an integral part of your production line and provides continuous marking operation. Write for complete information.

JAS. H. MATTHEWS & CO.
3923 FORBES ST. PITTSBURGH 13, PA.
BOSTON • CHICAGO • PHILADELPHIA • CLIFTON, N. J.

USE READER SERVICE CARD; INDICATE A-12-222-3

How to get the type of bushings you want in *your* die sets

Best way to get the quality die sets you want *plus* the type of bushing and pin assembly you prefer is to stamp "USE DETROIT DIE SET" on your blueprints. For here, along with a *full-value* die set, you have a choice of a dozen different bushing assemblies. For instance, the new *self-oiling bushings* that automatically lubricate friction surfaces. And then such types as *ball-bearing assemblies, Lamina bronze-plated bushings* with or without clamps, and solid *Ampco bronze bushings* with Alemite fittings.

For precision die work, specify a precision Detroit Die Set with the type of bushing that answers your specific needs.

Offices in Principal Industrial Centers

Detroit DIE SET CORPORATION

2895 WEST GRAND BOULEVARD • DETROIT 2, MICHIGAN

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-12-223

Zagar Gearless Drill Heads

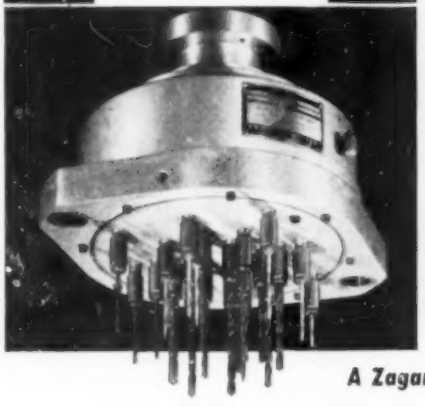
put 4 big advantages to work for you

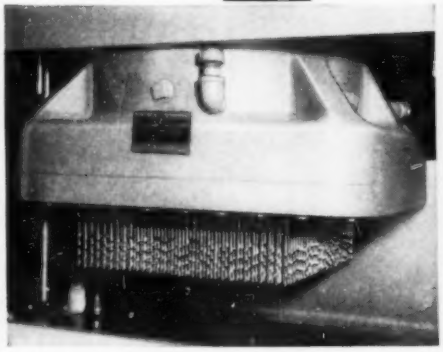
Any number of holes

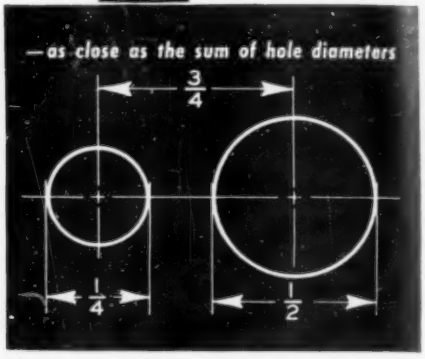
Any hole pattern

Any material

On all centers





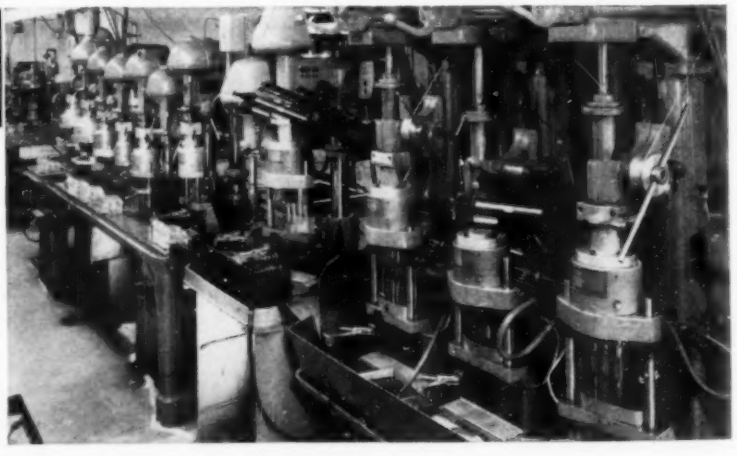


A Zagar drill head is never obsolete. Zagar can re-locate spindles for other hole patterns.

Can you visualize the savings made possible by drilling up to 1000 holes at one pass? Zagar standard practice can handle any machinable material up to 1½" diameter. Holes of varying diameters can be drilled to form any pattern. Zagar Gearless Drill Heads, their efficiency proven by many years' success, can be installed on existing drill presses. Or, Zagar will lay out the necessary tooling for your entire job. May we see your sample parts and study your requirements? There is only one *right* answer—one *best* answer—for those requirements. May we supply it?

Let ZAGAR tooling plan the complete job for you

Whether your runs are long or short, let Zagar engineering survey your needs with a view to saving you the cost of special machines. In the case at the right two lines of *standardized* self-clamping drill jigs ream, tap and drill an aluminum die casting, both valve body and cover. The problem of limited production was readily solved. What, sir, are your requirements?



ZAGAR TOOL, INC. 24000 LAKELAND BOULEVARD, CLEVELAND 23, OHIO

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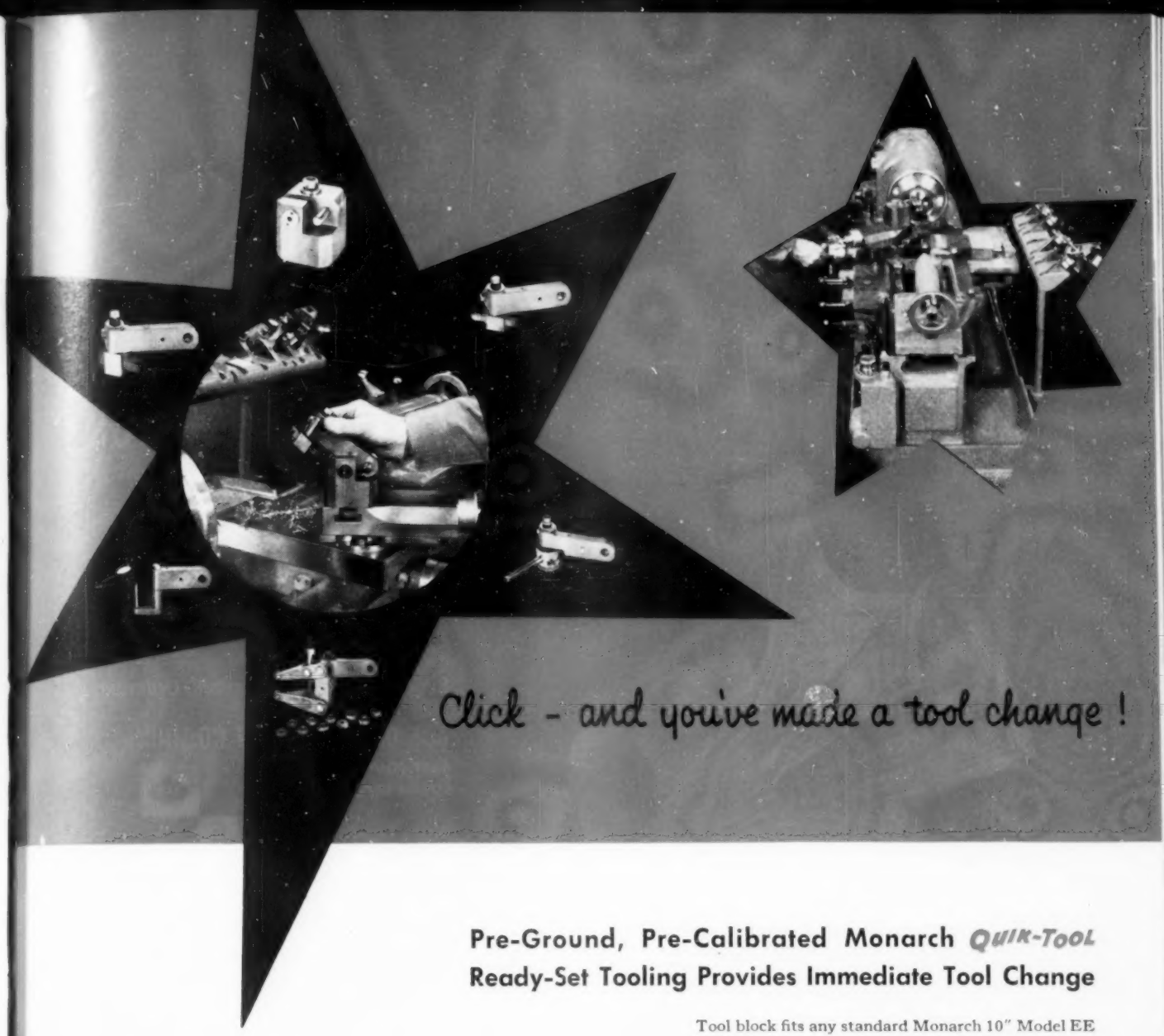

Pre-Ground, Pre-Calibrated Monarch QUIK-TOOL Ready-Set Tooling Provides Immediate Tool Change

What's Quik-Tool? It's a tool block and set of seven tool holders, all precision ground and pre-calibrated to provide better accuracy of positioning and response than you get from any turret.

And it's fast! Tools automatically position themselves when slipped onto a locating pin and swung into the slot of the tool block. They don't even have to be aligned or clamped into position, as the precision fit of tool holder and tool block insures rigidity and accuracy.

Monarch Quik-Tools are specifically valuable in the toolroom or instrument shop for practically any type of turning, with tools used in any desired combination or sequence. The standard tool setups can be used, without adjustment to tool settings, for a wide variety of jobs. Holders are designed for standard tools and gages.

How about it? Don't you want to know *all* about how Monarch Quik-Tool eliminates lengthy setups and cuts tool change time to seconds? Send for our complete illustrated booklet today . . . . . ***The Monarch Machine Tool Company, Sidney, Ohio.***

Tool block fits any standard Monarch 10" Model EE Toolmaker's or Manufacturing Lathe compound rest "T" slot. Tools can be used in any combination or sequence for turning, boring, facing, chamfering, grooving, necking, threading, knurling, or cut-off. The tools automatically position themselves.

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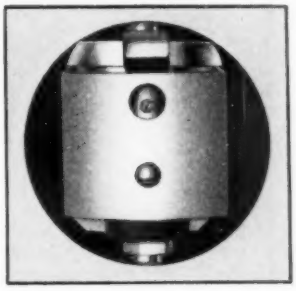
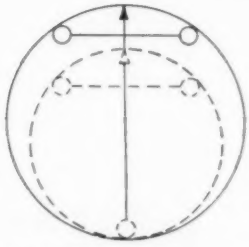


The New DIAL INDICATOR BORE GAGE

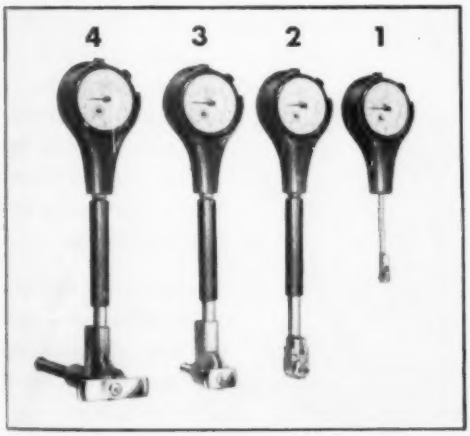
FOOLPROOF CENTRALIZATION



Centralizer places contacts on true diameter of hole.

- *Meets the great majority of all hole inspection needs.*
- *Longer gaging range.*
- *Four gages inspect all diameters from ½" to 8".*
- *Accuracy protected from handling temperature.*

Model 1250P-Series



These new Gages definitely meet the accuracy requirements of nearly all hole diameter inspections . . . and at a cost considerably less than that of more elaborate gaging equipment.

They are designed to give accurate centralization for setup with gage blocks, micrometers, master rings, or other suitable device.

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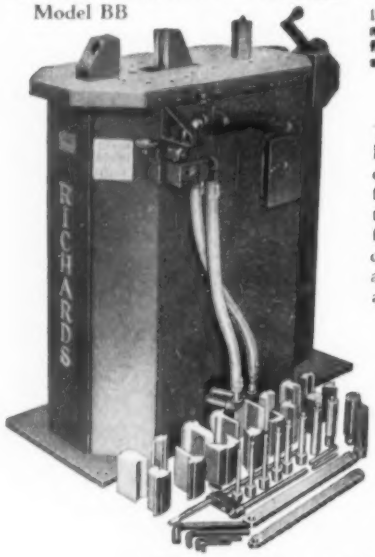

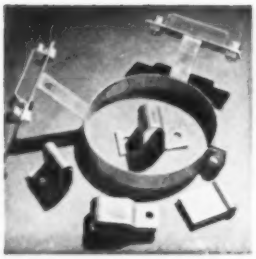

Illustrated above are a few of the many forms that can be produced efficiently on the Multiform Bender using the standard tooling.

The heavy duty Big Brother Bender is designed for fabricating bus bars, brackets, fixtures, etc., without special tooling. Air controlled with finger tip response. Comes complete with dies, mandrels and wrenches—punching and blanking dies extra.

Will punch holes up to 1" and form material up to ¼" thick by 4" wide. We also build smaller hand or air operated models for forming up to ⅛"x1½" material. These machines are solving new forming problems in many plants and could be the answer to yours.

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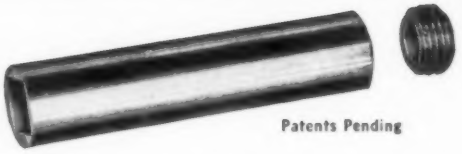

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One of the most difficult problems in tool making can be solved easily and quickly with Sturdy Square Holed Sleeves. The perfection of broached square holes can be had in boring bars, milling cutters and many other applications at a small fraction of the cost of imperfect hand-made square holes. The sturdy Square Holed Sleeve consists of a round sleeve with a perfectly square hole broached through the center. This hole is tapped at one end to receive a back-up screw which is furnished with the Sleeve. The Sleeve can be sweated or pressed into a drilled and reamed hole to make a perfectly square accurate hole in a very few minutes.

The Sturdy Square Holed Sleeve will save you many hours and many dollars in the making of boring bars, tool holders and other tools requiring square holes.

SLEEVES MADE IN FOLLOWING SIZES:
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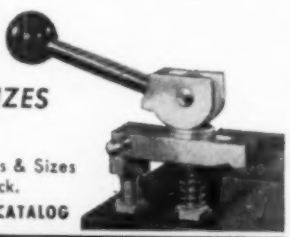

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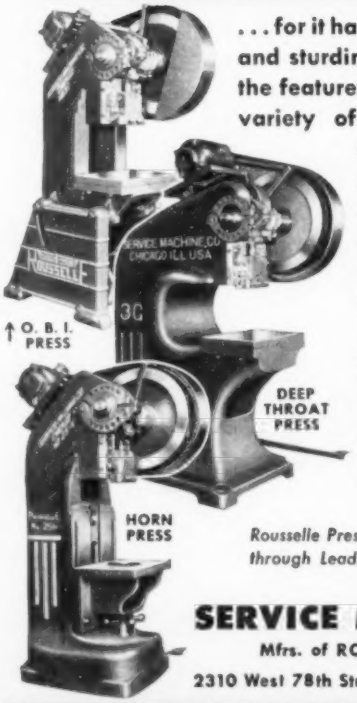

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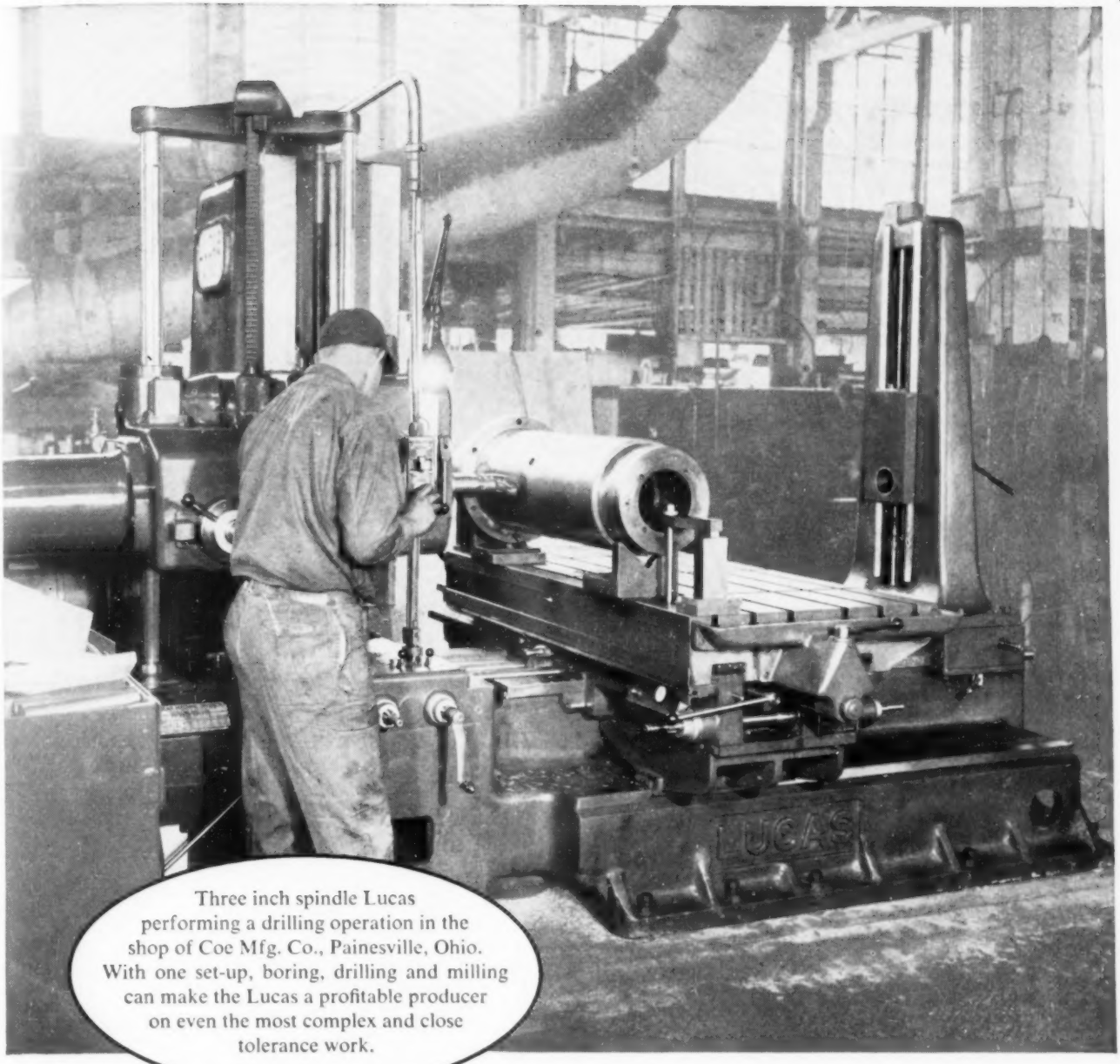

Three inch spindle Lucas performing a drilling operation in the shop of Coe Mfg. Co., Painesville, Ohio. With one set-up, boring, drilling and milling can make the Lucas a profitable producer on even the most complex and close tolerance work.

If you operate a contract shop, JUST ONE LUCAS will enable you to out-bid competition on a wide variety of work.

It will prove to be your most versatile and PROFITABLE machine — on one piece or a thousand — because it can perform a wider variety of operations than is possible on any other machine in your shop.

On many contracts your new Lucas will cut a big slice out of your COST DOLLAR and add substantially to your PROFIT DOLLAR.

A moderate investment will put this smaller size 3″ spindle, table type Horizontal Boring Machine to work making money for you.

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Lucas Horizontal Boring, Drilling and Milling Machines

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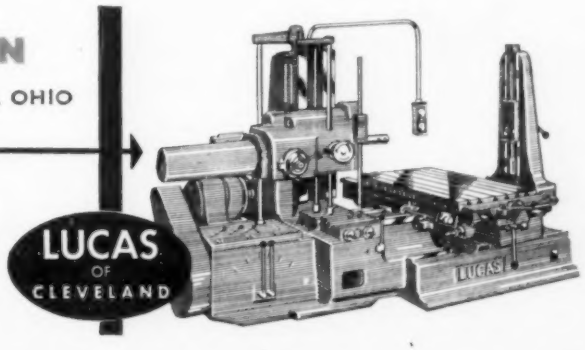

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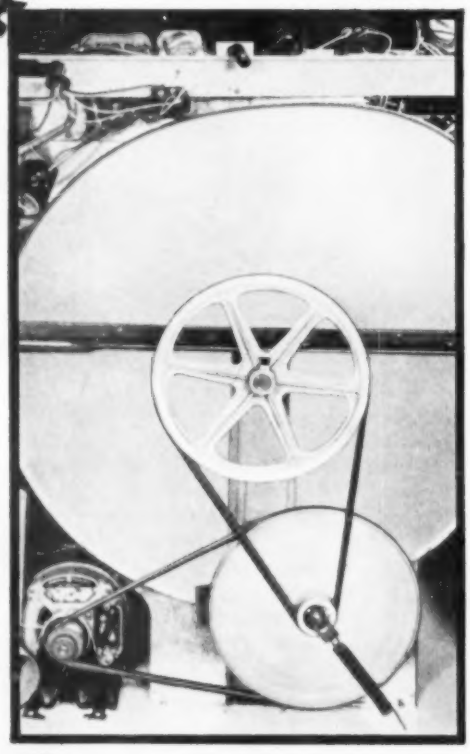

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The new U. S. VIBRA-LESS Belt brings new efficiency to washing machines, driers, belt-driven fans, air conditioners, machine tools, grinders and a host of other applications. *Electronic tension* and a *new molding method* are the reasons why.

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U. S. VIBRA-LESS Belts are obtainable through any of the 27 "U. S." District Sales Offices or any of the selected "U. S." distributors.

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Hanna ¼" Valves control air, oil or water pressures up to 500 p.s.i. The control lever requires only 80° movement for reversal. Hanna ¼" Valves are 4-way but can be made 3-way, by plugging one port. Three models — column, standard and manifold mount—are available. Ideal for tubing and light piping.

ELECTRIC VALVES

The Hanna 4-way Solenoid Valve is small, compact, with low current consumption. It is adaptable to straight line piping—capacity is equal to rated pipe size. Of balanced spool type, it has a built-in solenoid pilot valve. Piping may be from bottom, sides or a combination. Available in ⅜", ½", ¾" and 1" pipe sizes.

Hanna® valves

CHOOSE FROM a broad selection of Hanna Valves to meet your requirements for exacting Air and Hydraulic control. Illustrated are but a few of the complete line of hand, foot, electric and pilot operated valves for directional and speed control. They all carry the Hanna nameplate—an assurance of extraordinary care in design and manufacture—which means years of maintenance-free operation. Your Hanna sales representative offers specialized experience in selecting valve combinations and developing control circuits.

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Hanna Valve Catalog No. 254 includes descriptions and specifications on the complete line.

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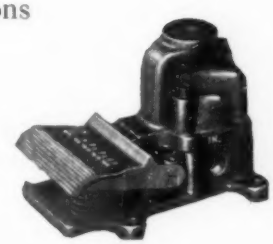
Hanna Flo-Set Valves have micrometer graduations to assure exacting speed control. Available in ¼", ⅜", ½" and ¾" sizes, they are suitable for air, oil or water control, with maximum pressure to 250 p.s.i. They may be mounted in any position.

UNITITE VALVES

Unitite Valves are suitable as either 3-way or 4-way valves, operating at air, oil or water pressures up to 250 p.s.i. for the ⅜", ½", and ¾" sizes . . . up to 150 p.s.i. for the 1" size . . . and up to 100 p.s.i. for the 1¼" size. Three styles—for standard mounting, column mounting or manifold mounting—are available.



FOOT OPERATED VALVES

Available in ⅜", ½", ¾" and 1" pipe sizes, Hanna Foot Valves are ideal for applications where it is desirable to have the operator's hands free for handling material. Single-pedal and double-pedal models, for pressures up to 250 p.s.i., are available for use with double-acting air and hydraulic cylinders.

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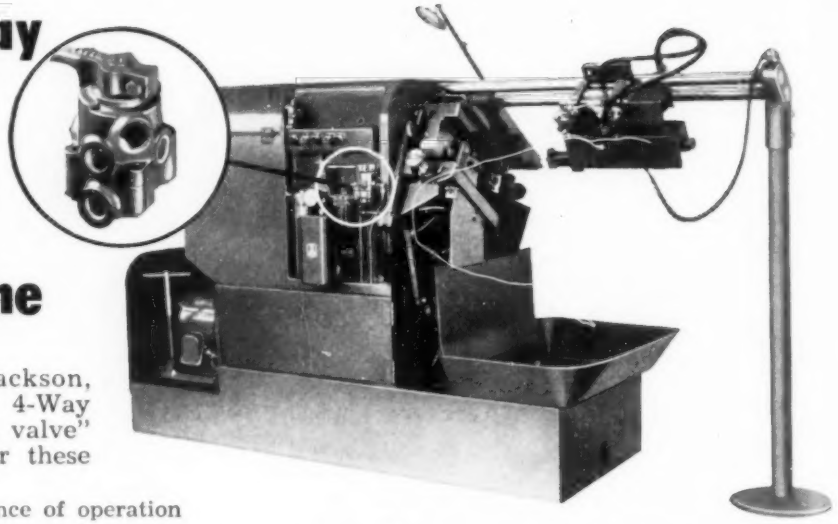
NOPAK Dual 4-Way is Main Air Control on "Modern" Cutting-Off Machine



Modern Machine Tool Co., Jackson, Mich., uses the NOPAK Dual 4-Way valve as the "main air control valve" on its Cutting-Off Machine for these reasons:—

1. It provides the necessary sequence of operation control.
2. It is "easily mounted . . . in readily accessible position".
3. It directs air pressure either to part of the air system, or the whole system, as required.
4. With valve lever at 45°, "the operator can set the tools, with a gauge, against the stock while it (the stock) is locked in the collet".
5. In normal running position with valve lever at 90°, air is directed to other parts of system, while maintaining pressure on collet cylinder during cutting cycle.

This application may suggest how you can use NOPAK Valves and Cylinders for effective control and application of fluid power in your product, or in your plant equipment. For other suggestions see the NOPAK Application Manual.

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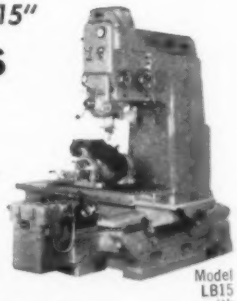

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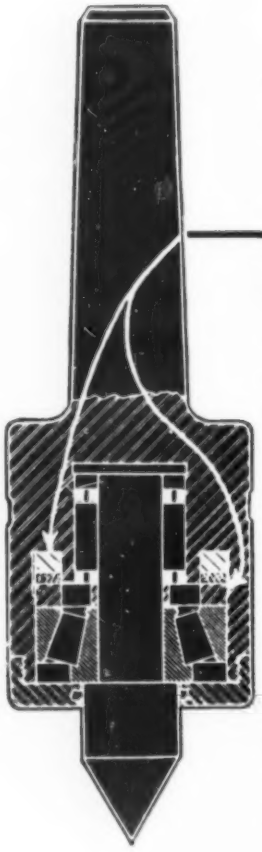

This resilient pad absorbs the shocks and prevents breakage of the tool or spoilage of the piece being machined.

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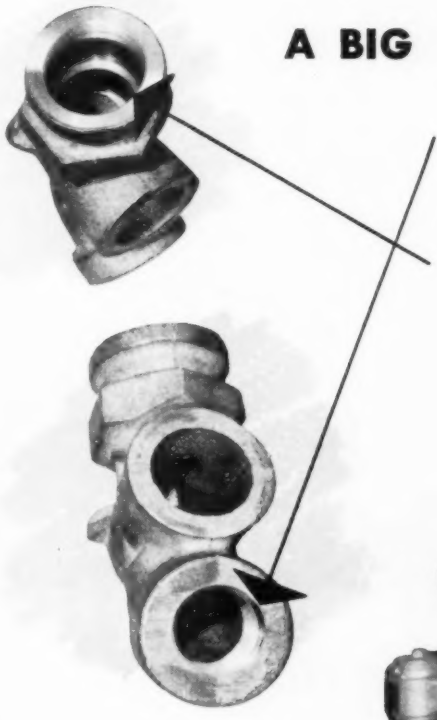

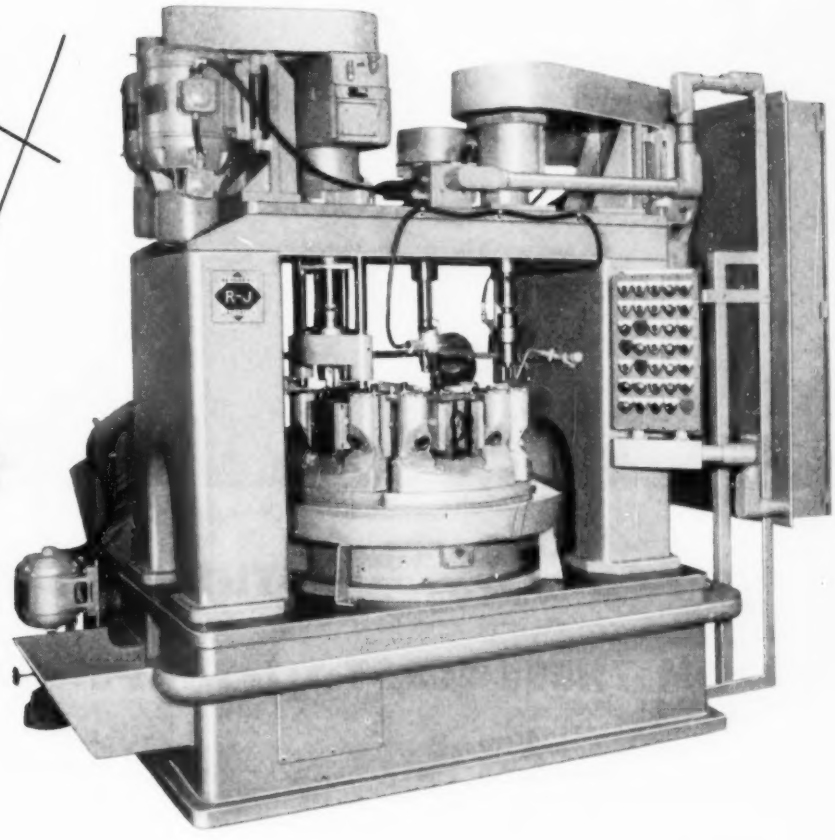

Two views of this husky railway air valve are shown above. The top view looks down into the upper hole, where most of the machining is done, as described below. This hole has three stepped diameters, two chamfers, a facing operation, and an undercut. The lower hole, shown in the bottom view, is a standard 1¼" pipe thread at 60° from the vertical axis.

"Built Like a Little Brick Church"...

The purchaser of this Rehnberg-Jacobson 5-Station *Bridge-Type* Automatic Index machine likes it because it has a lot of extra "beef" in it. This ruggedness is necessary, because the big air cock it machines is used in heavy railway service. Castings are held in equalizing jaws operated mechanically by an air-driven impact tool. From the top, the piece is (a) combination bored, faced, and chamfered on 3 diameters simultaneously, (b) finish bored on the same three diameters, (c) undercut and chamfered for a sealing member, and (d) tapped 2-1/8"–16 special. During the same sequence, two angular units move in to core drill and tap 1-1/4" NPT the lower hole. All units, including the 36" 5-position Index Table, are *all-mechanical* R-J products. Capacity is rated at 106 pieces per hour. *This machine, like many others we have designed and built, is easily adaptable for machining other sizes or models of similar valve bodies.*

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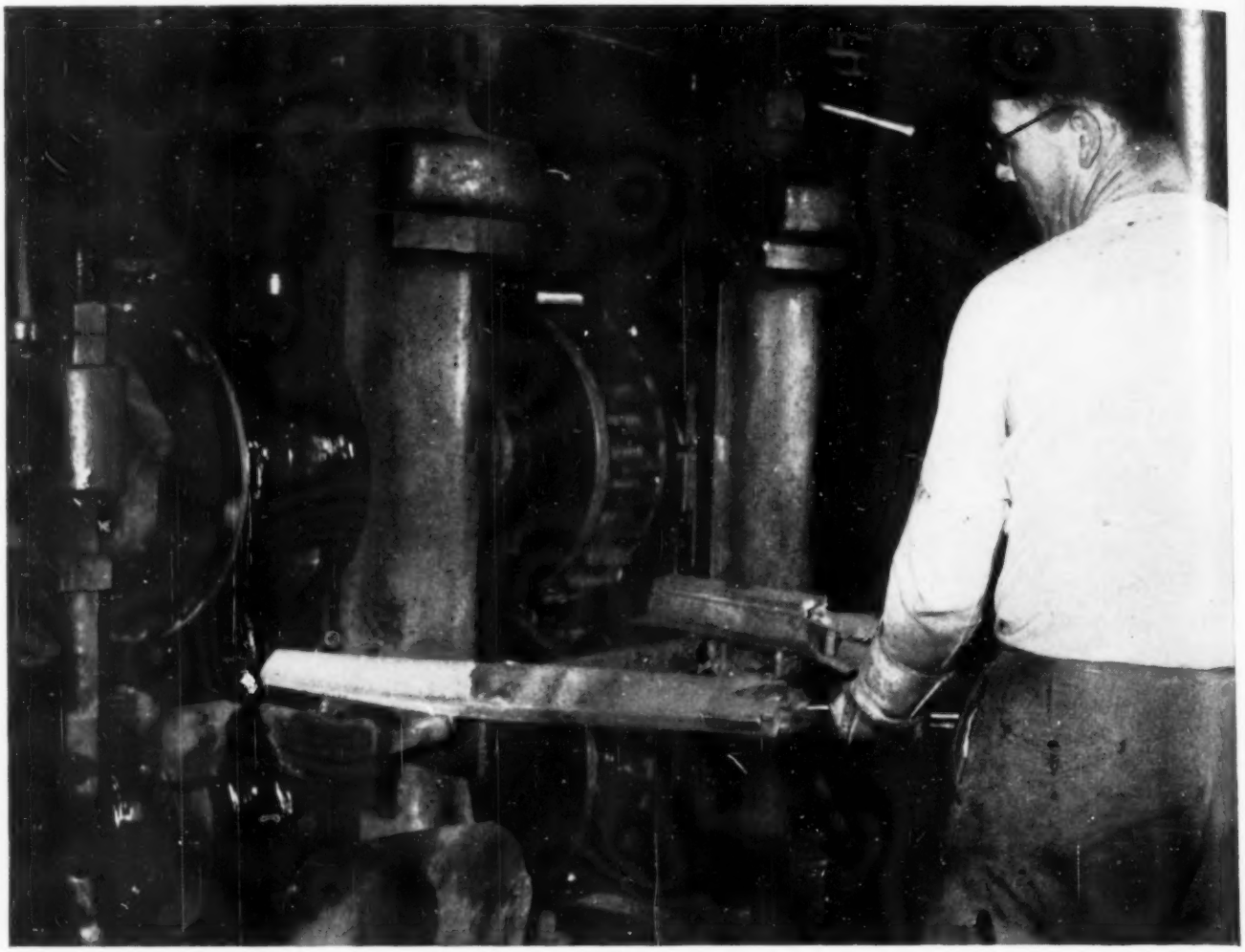
REHNBERG-JACOBSON MANUFACTURING COMPANY

ROCKFORD, ILLINOIS



10 TIMES THE PRODUCTION LIFE

FROM THESE "CAST-TO-SHAPE" SWAGING DIES

SEND FOR THIS NEW CATALOG
"FORGING AND CASTING PRODUCTS"

It's hot off the press with full details on FCC Air Hardening, Oil Hardening and other Cast-to-Shape Tool Steel Specialties that can save you time and money . . . also Composite Die Sections, and Smooth-Hammered Forgings in a wide range of tool and stainless steels. *Don't wait—get your copy NOW.*

Write Today

ADDRESS DEPT. TE-72

The John Deere Plow Works of Deere & Company formerly used cast grey-iron dies to swage AISI 1070 F steel plow beams. Die life was, at best, a mere six weeks or about 8,000 parts.

They switched to A-L CAST-TO-SHAPE swaging dies of FCC No. 66 tool steel, hardened and drawn to 57-58 Rockwell "C". The new dies ran *fourteen months*—eight hours a day, five days a week—before redressing was necessary. Approximately *83,875 Parts* (over ten times the production) were swaged in that period! Production has been maintained at that level since.

You, too, can save time and money with the modern FCC CAST-TO-SHAPE method of tool and die making. Don't forget, you also buy *less* steel and reduce machining costs. It's a matter worth investigating. ● Check with your A-L representative TODAY . . . or write *Allegheny Ludlum Steel Corporation, Oliver Building Pittsburgh 22, Pennsylvania.*

For complete **MODERN** Tooling, call

Allegheny Ludlum

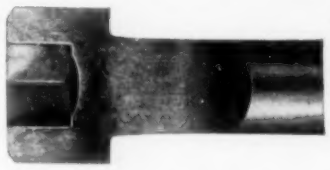
AL
FINE TOOL STEELS
SINCE 1854

W&D 469

The BUY word for Socket Cap Screws is ALLEN

The *easy* way to make sure of greater strength, better fit and uniform quality in socket cap screws is to order "not just Allen-type but genuine ALLEN."

PRESSUR-FORMING



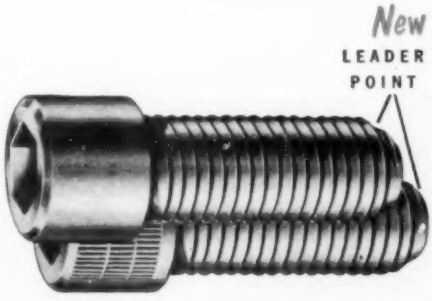
The latest improvement in the cold forging method originated by Allen. The tough Allenoy steel fibers are preserved continuous and uncut.

GRIP HEAD CAP SCREWS
The world's easiest starting, straightest driving, firmest holding cap screws.

FLAT HEAD CAP SCREWS
For firm fastening with flush surfaces. Especially adapted to fastening thin plates and sheets.

BUTTON HEAD CAP SCREWS
Produces smooth streamlined appearance where countersinking is impractical.

STAINLESS STEEL



Bright, non-corroding high tensile strength type 18-8. 151 popular sizes (NC & NF) with Smooth Heads *available from stock*. Also standard with Grip Heads in many popular sizes.

THE ALLENUT

Provides a ready-made threaded hole for use with cap screws in soft materials and for repair applications. Endless uses for compact design, space saving.

Sold Only Through Leading Industrial Distributors

Take advantage of their large stocks and fastener experience. Write direct for General Catalog G55.

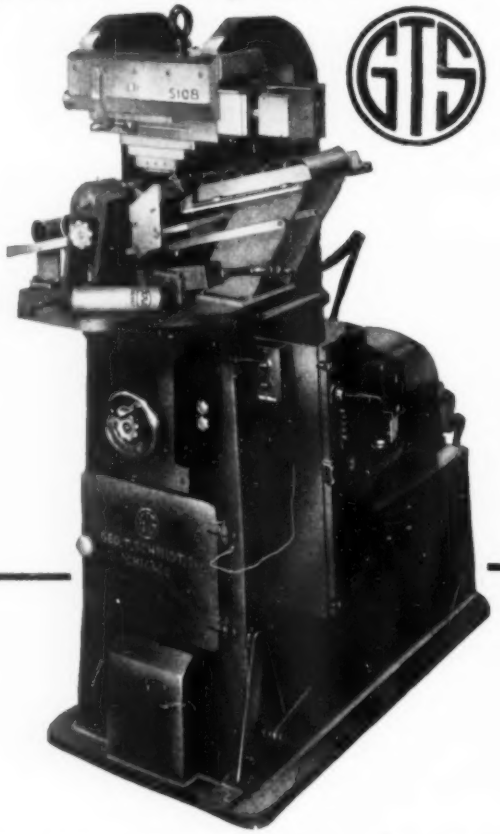
ALLEN
MANUFACTURING COMPANY
Hartford 2, Connecticut, U.S.A.

ALLEN HEAD

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-12-237

MODERN MARKING METHODS

Mean faster, more uniform, less expensive identification of products and parts . . .



This high-speed, fully automatic tube marker is typical of GTS-designed production marking machines. It rolls a trade mark and part number on mild steel thin-walled tubes—*2500 to 3000 of them per hour*—making all impressions clean, accurate, and exactly uniform. It speeds production and cuts costs for a major automotive manufacturer.

This machine, or another unit of the extensive GTS line of Production Marking Machines, can reduce cost and increase production in your marking operations, too. To find out how—at no obligation—write today for an appointment with a GTS Sales Engineer.

IF IT'S WORTH MAKING, IT'S WORTH MARKING.

GEO. T. SCHMIDT, INC.
1810 Belle Plaine Avenue
Chicago 13, Illinois

USE READER SERVICE CARD; INDICATE A-12-238-1

THE VISE WITH A
THOUSAND GRIPS

"FLEXIBLE JAWS" GRIP *ANY* SHAPE!

Positive grip vise. Grips any irregular shape. Grips secure and positive for the most precise milling, drilling or cutting operation. Eliminate the time and expense of blocking and shimming irregular pieces for toolroom machining. Try it in your shop. Save time and dollars on small production runs. Write for complete information now.

AT THE PHILADELPHIA SHOW—BOOTH 2047

AMPOGRIP CONTOUR GRIPPING UNIVERSAL FIXTURES

AMERICAN POSITIVE GRIP VISE CORP.
4-F Olivine Street • Willimansett, Mass.

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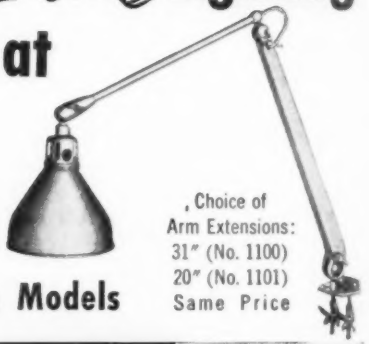
Air-Cooled Lighting by Dazor at Low Cost



Adjustable-Arm Models

, Choice of Arm Extensions: 31" (No. 1100) 20" (No. 1101) Same Price

Light up machines and benches at rock-bottom cost and get Dazor dependability besides. New Adjustable-Arm Lamps mount solidly, hold fast in any position set. Either top- or side-mounted reflector. Air-cooled housing is safe to handle despite continuous use. Gray baked enamel over bonderizing. Call your Dazor distributor. Dazor Manufacturing Corp., St. Louis 10, Missouri.

. . . Makers of

DAZOR FLOATING LAMPS

USE READER SERVICE CARD; INDICATE A-12-238-3

How Pipe Machinery Gages Insure You

You buy gages to insure your customers' acceptance of your product.

Any sacrifice in gage quality increases your chance for rejects . . . and lessens your insurance.

The Pipe Machinery Company pledge to industry to produce and sell only the best at a fair price warrants consideration.

Highly skilled artisans, each dedicated to the PMCo pledge, select and treat the finest of materials in our modern heat treating department, carefully machine, finish, and finally inspect every gage.

There can be no price reduction without a quality reduction.

Are you buying the best possible protection . . . insurance . . . for your company's product?

THE PIPE MACHINERY COMPANY

29101 LAKELAND BLVD. WICKLIFFE, OHIO

Greater Cleveland

The Finest Since 1911

Today Get the Pipe Machinery Co. Catalog #10. Fill in this coupon.

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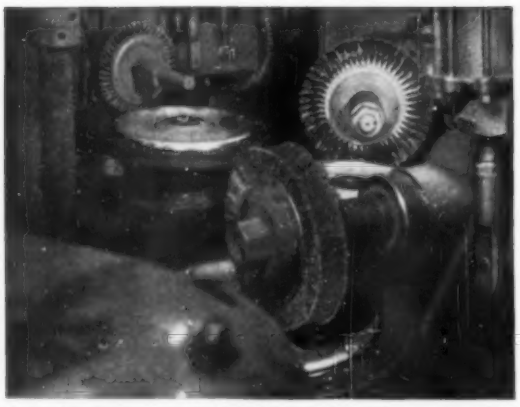
BEFORE BURR REMOVAL

AFTER BURR REMOVAL

Removing burrs for trouble-free transmissions



One of many automatic brushing setups used by automotive manufacturers to finish transmission parts and other components.

BURRS left on automatic transmission parts can break loose in service, clog hydraulic lines and cause serious damage.

The two sections of a transmission cover shown above prove how thoroughly power brushing removes burrs and blends surface junctures . . . leaves the part smooth and clean.

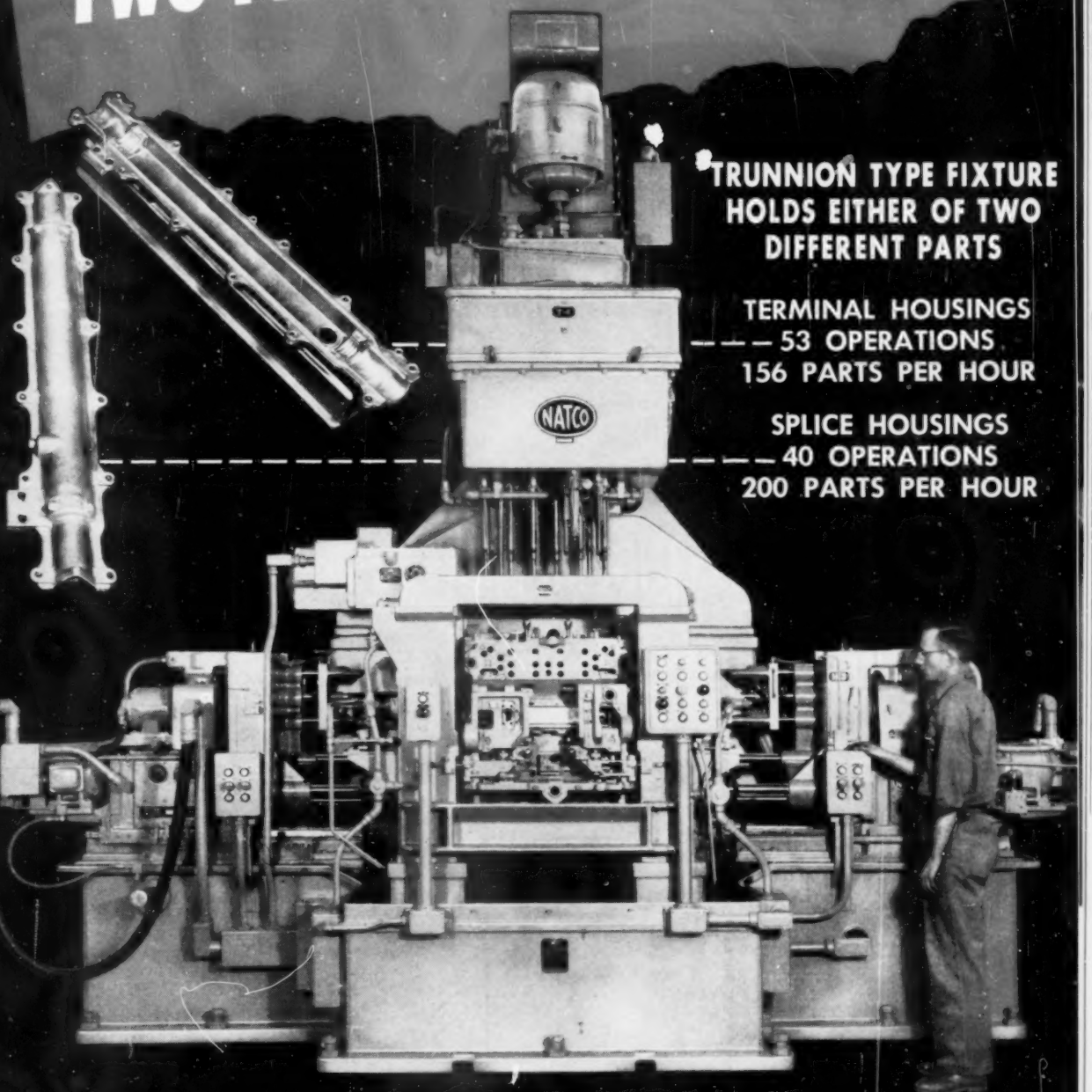
Have an **O**sborn **B**rushing **A**nalysis made of your operations. It costs you nothing, but may save thousands of dollars in your finishing of parts. Write *The Osborn Manufacturing Company, Department K-18, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

Osborn Brushes

OSBORN

BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES
BRUSHING MACHINES • FOUNDRY MOLDING MACHINES

NATCO 3-WAY DRILLER and TAPPER COMBINES 93 OPERATIONS ON TWO PARTS TO REDUCE COSTS!



TRUNNION TYPE FIXTURE HOLDS EITHER OF TWO DIFFERENT PARTS

TERMINAL HOUSINGS
53 OPERATIONS
156 PARTS PER HOUR

SPLICE HOUSINGS
40 OPERATIONS
200 PARTS PER HOUR

NATIONAL AUTOMATIC TOOL COMPANY, INC.
RICHMOND, INDIANA

for answers to your Drilling, Boring, Facing and Tapping problems

Call a Natco Field Engineer

CHICAGO, Room 203, 6429 W. North Ave., Oak Park
DETROIT, 10138 W. McNichols Rd.
BUFFALO, 1807 Elmwood Ave.,
NEW YORK, 35 Beechwood Ave., Mount Vernon

NATCO

EPOCAST

A FURANE Representative Is Awaiting Your Inquiry

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• THE HOUSTON COMPANY
107 Administration Building
Boeing Field
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• BURNHAM PRODUCTS, INC.
601 North Athenian Street
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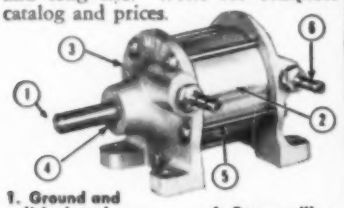
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-12-242-1

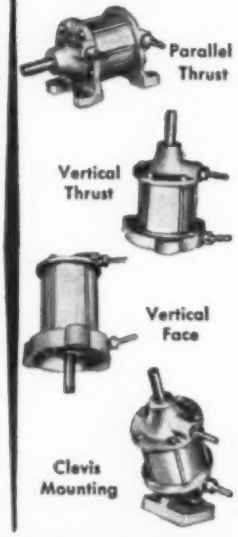
AIR-MITE AIR CYLINDERS
Low Cost... Compact... Powerful... Rugged

AIR-MITE Cylinders—made in single or double acting series—in 4 mounting types, are high quality cylinders at a low price. Simple, rugged design and compact construction give them long life, permit easy mounting on jigs, fixtures, tools, or machines. Used wherever power holding, pushing, pulling or lifting is required, AIR-MITE cylinders will meet your most exacting standards of dependability and long life. Write for complete catalog and prices.



1. Ground and polished steel ram
2. Brass, true-bore cylinders
3. High strength aluminum alloy cylinder heads
4. Bronze oilless ram bushing
5. Five steel tie rods
6. Brass hose stems

4 Mounting Types



AIR-MITE Devices, Inc.
4418 W. CARROLL AVENUE • CHICAGO 24, ILLINOIS

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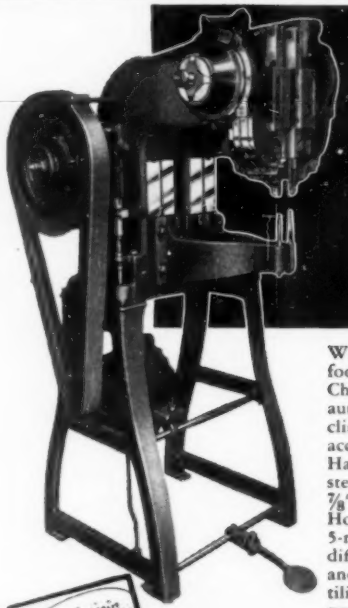


LOWER THE BOOM ON COSTS
SET RIVETS FAST
2 at a time with the Chicago "214"

With every press on foot pedal Model 214 Chicago Double Rivet Setter automatically feeds, inserts and clinches *two* rivets. 14-inch throat accommodates large assemblies. Handles 9/64" diameter or smaller steel tubular rivets—lengths to 7/8". Quick Change Rotary Type Hoppers and Raceways permit a 5-minute changeover to rivets of different size. Adjustable anvils and riveting centers add to versatility. For help with fastening problem... send sample assembly (or a blue print) for free fastening analysis.

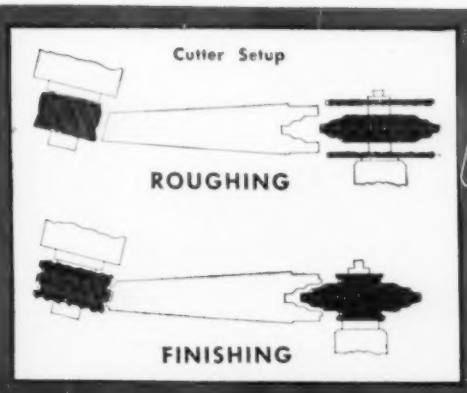
FREE CATALOG contains valuable engineering information and rivet specifications plus illustrated descriptions of 26 Chicago Automatic Rivet Setters.

Chicago Rivet & MACHINE CO.
9619 West Jackson Boulevard, Bellwood (Chicago Suburb) Illinois
Branch Factory: Tyrone, Pa.

USE READER SERVICE CARD; INDICATE A-12-242-3

CUSTOMER SPECIFIED

KEARNEY & TRECKER MILWAUKEE DESIGNED



A leading electrical equipment manufacturer needed a production machine to rough-and-finish mill a variety of sizes of chrome-nickel-steel steam turbine blades — 4" to 30" long. Specifications called for a machine that would cut milling costs and maintain accuracies within thousandths of an inch. Solution: They called on Kearney & Trecker to develop and build the machine.

Production rates are dependent upon workpiece size. For example, twenty-seven 13½" chrome-nickel-steel blades are rough-and-finish milled per hour by this new Kearney & Trecker Two-Spindle Bed Type machine.

Rectangular index table with two work-holding fixtures enables the operator to unload and load one fixture while the other is in work. This sequence eliminates down-time and keeps production constant.

Dovetail end of blade is rough-and-finish milled with the lower spindle, using a combination of special form and side mills. Head, mounted in an inverted position on a saddle, is counterweighted. Tenon end of blade is milled with the upper vertical head which moves in an arc on radial ways . . . angular adjustment of 45° is possible.

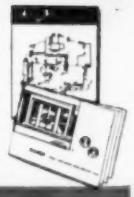
Other machine features include air-clamping for machine table . . . automatic chip conveyor . . . high volume coolant pump . . . easy to change pick-off gears for each head to select exact desired spindle speeds.

New production efficiency starts with Kearney & Trecker Milwaukee machine tools

Kearney & Trecker automatic production machines perform many operations to exacting accuracies and at lower cost. But most important to you — it's accomplished by combining standard design components with a minimum of special engineering. This means you get the production you want, the economies you need, from job-proven designs with minimum of capital investment.

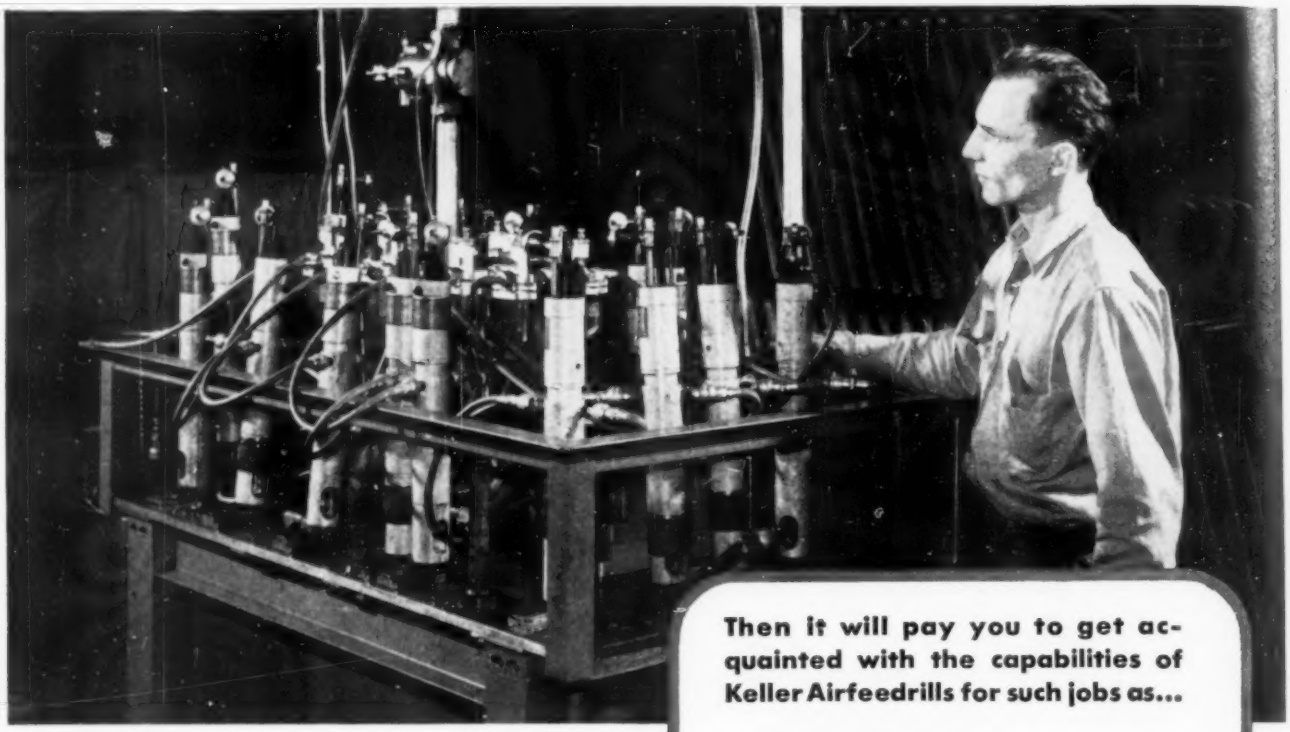
With more than 50 years' experience in machine design and manufacture, Kearney & Trecker has the all-around ability to meet your production needs. Take advantage of these abilities. They can pay off in lower machining costs and more profits for you. See your Kearney & Trecker Special Machinery Division representative. He'll be glad to help you with your production requirements. Call him today.

For more details on machine illustrated ask for Data Sheet No. 1067. Booklet "Doorway to a proven method for solution of big and small metalworking problems" is also yours for the asking.



Builders of Precision and Production Machine Tools Since 1898

Can automatic production help you improve quality . . . *reduce costs* ?



A typical automatic production setup using 14 Keller Airfeedrills. Pressing a single control valve drills 14 holes simultaneously in a refrigerator outer shell assembly—the drills advance, drill, retract, and shut off automatically.

These remarkable tools work without supervision, and take the place of expensive machines in automation setups. They are entirely air controlled and operated, automatically cycled, and extremely accurate.

Among the special advantages available are sensing type rapid advance, hydraulic feed control, and adjustable torque control. Thus they are able to do peck drilling, skip drilling, and other jobs that heretofore have required expensive machine tools.

Write and tell us about your machining problems. We will send appropriate bulletins or have a representative call to discuss Keller Air Tools.

Then it will pay you to get acquainted with the capabilities of Keller Airfeedrills for such jobs as...

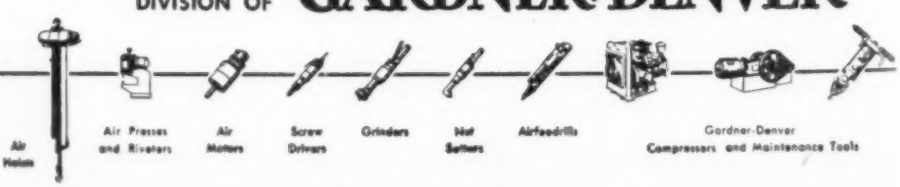
- **DRILLING**
- **REAMING**
- **COUNTERSINKING**
- **TAPPING**
- **CENTER DRILLING**
- **CHAMFERING**
- **COUNTERBORING**
- **SPOTFACING**

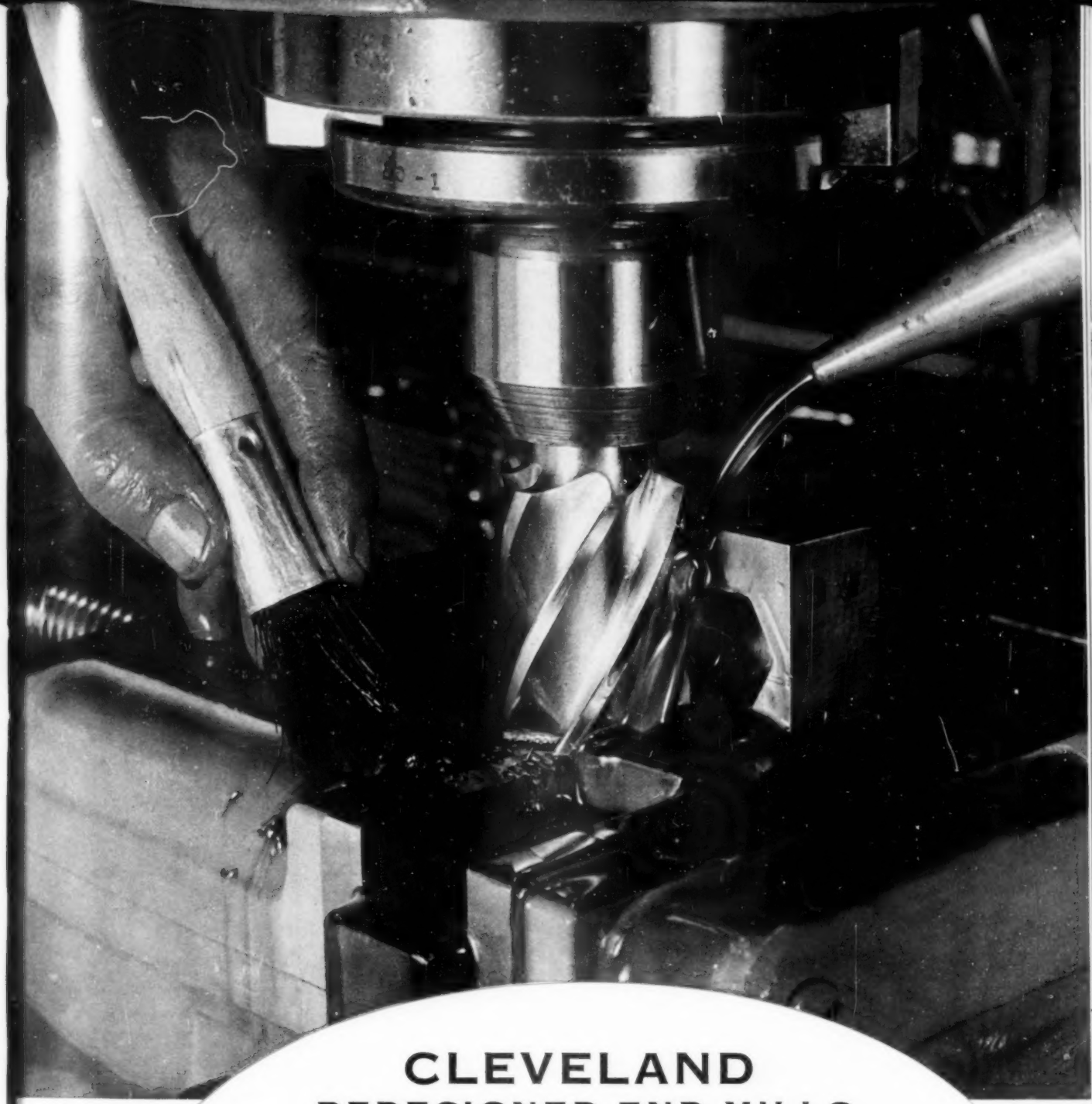
GARDNER-DENVER Since 1 K KELLER TOOLS

KELLER TOOL

DIVISION OF GARDNER-DENVER

GRAND HAVEN, MICHIGAN





CLEVELAND
REDESIGNED END MILLS

Cut faster • Clear chips better
Greater accuracy • Stronger • More durable

Engineered to give you maximum cutting qualities at greatly increased rates of feed, with a minimum amount of wear.

THE **CLEVELAND** TWIST DRILL CO.
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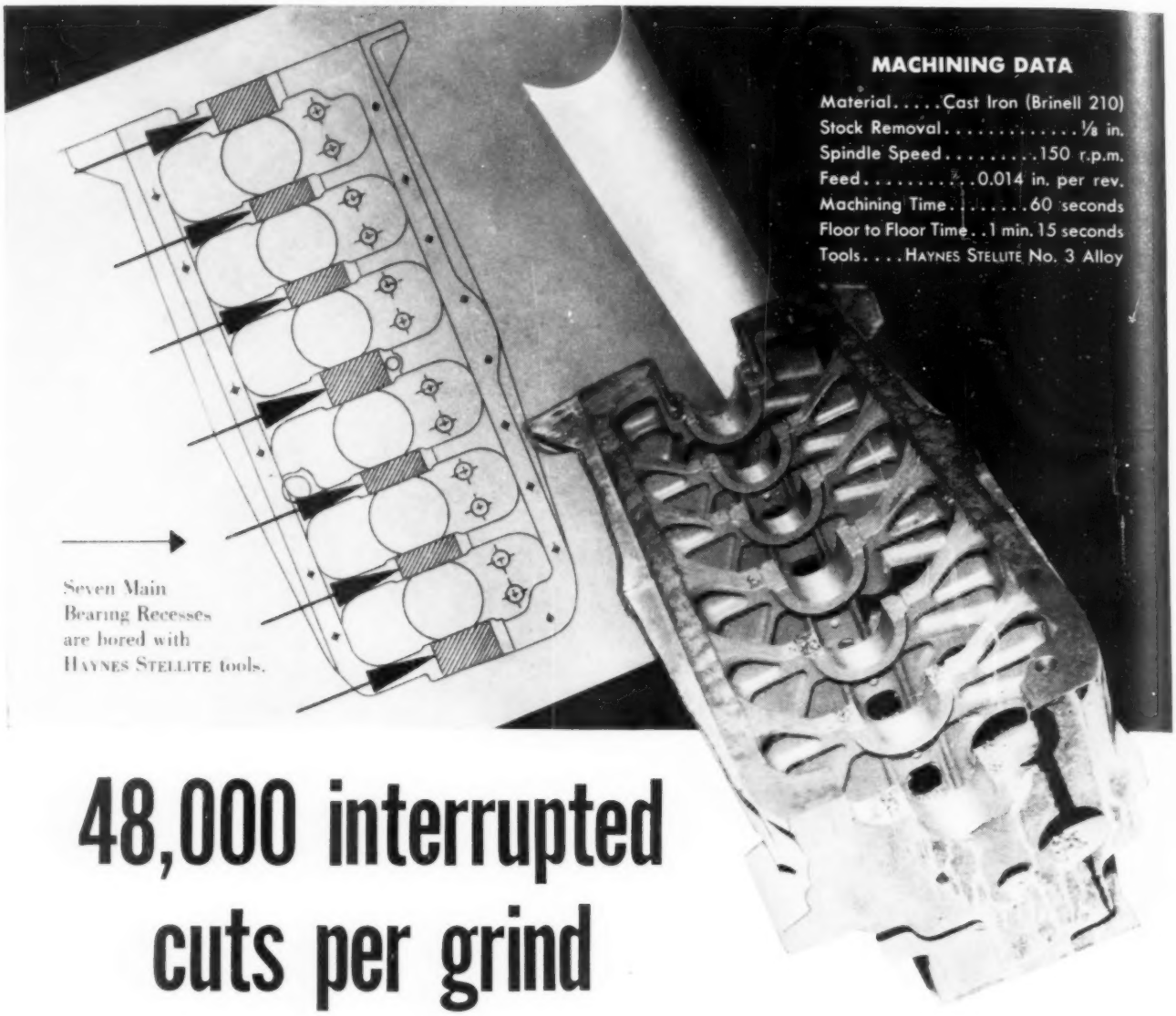
Stockrooms: New York 7 • Detroit 2 • Chicago 6 • Dallas 2 • San Francisco 5 • Los Angeles 58
E. P. Barrus, Ltd., London W. 3, England

TELEPHONE YOUR INDUSTRIAL SUPPLY DISTRIBUTOR


MACHINING DATA
Material.....Cast Iron (Brinell 210)
Stock Removal.....⅛ in.
Spindle Speed.....150 r.p.m.
Feed.....0.014 in. per rev.
Machining Time.....60 seconds
Floor to Floor Time..1 min. 15 seconds
Tools....HAYNES STELLITE No. 3 Alloy
Seven Main Bearing Recesses are bored with HAYNES STELLITE tools.

48,000 interrupted cuts per grind

HAYNES STELLITE tools machine the main bearing recesses in 320 cast iron engine blocks between grinds. Each of 14 tools used in the set-up makes 150 interrupted cuts in each block . . . a total of 48,000 interrupted cuts per grind. The tools remain in operation for a full eight-hour shift, without chipping or spalling. Other tools tested on this job chipped under the constant hammering of the intermittent cuts, and had to be replaced in less than an hour.

Standard tool bits ⅜ in. square and 2 in. long, made of HAYNES STELLITE alloy No. 3, are used for this operation. Only 0.015 in. of metal has to be removed when the tools are sharpened, and the tools can be reground about 30 times. Then, when they are too short to be used for boring the main bearings, they are used to machine the smaller cam bearing recesses. In this second operation the same tools can be reground about 50 times more!

There are four grades of HAYNES STELLITE metal-cutting tools varying in hardness, compressive strength, and impact resistance. For a complete description of properties, sizes, and recommended operating data, write for the free booklet, "HAYNES STELLITE Metal-Cutting Tools."

HAYNES
TRADE-MARK
ALLOYS

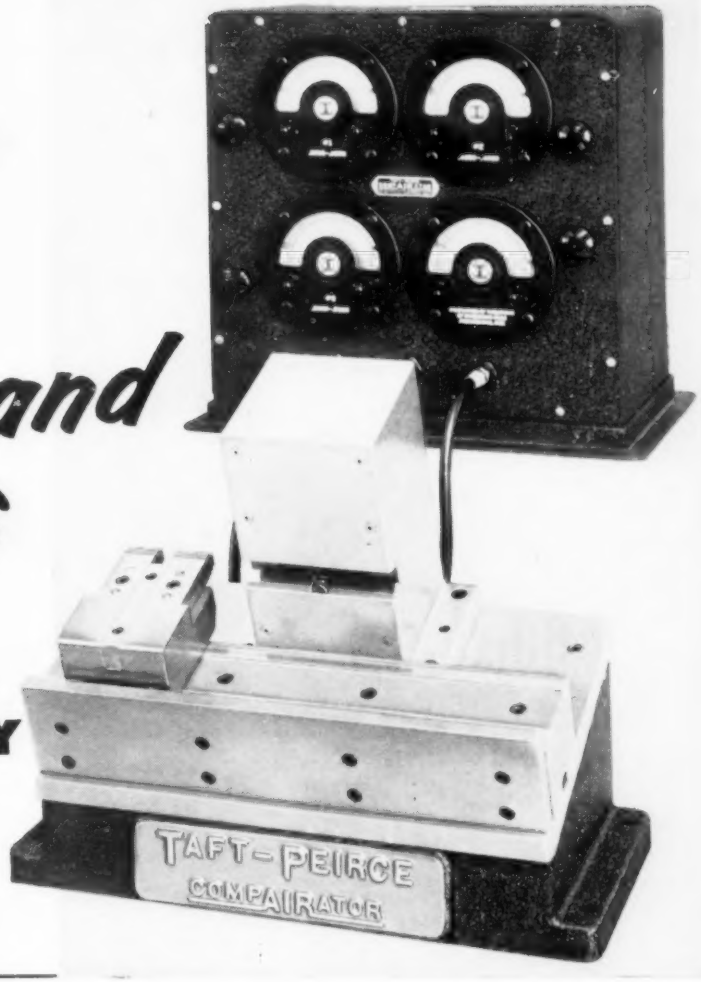
HAYNES STELLITE COMPANY
A Division of Union Carbide and Carbon Corporation
UCC
General Offices and Works, Kokomo, Indiana
Sales Offices
Chicago • Cleveland • Detroit • Houston • Los Angeles • New York • San Francisco • Tulsa

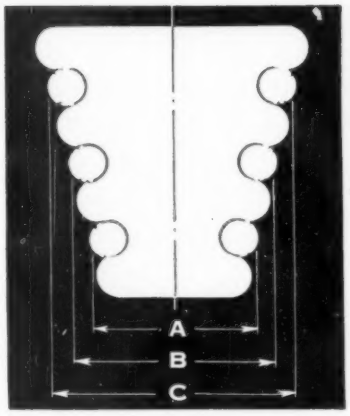
"Haynes" and "Haynes Stellite" are registered trade-marks of Union Carbide and Carbon Corporation

New Taft-Peirce CompAIRator Air Gage

Measures and Computes

4 DIMENSIONS SIMULTANEOUSLY



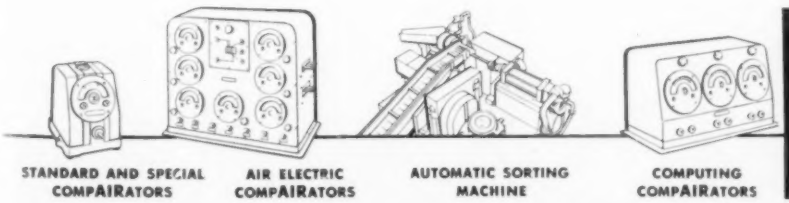


The CompAIRator above checks serrations in the root section of jet engine turbine blades. Does automatically and instantly what formerly took skilled hands many minutes to do.

Three of the air indicators measure thickness "over rolls" of the serrated sections. At the same time, a T-P Computing CompAIRator computes the difference between two of these dimensions and compares it to a standard value. If the variation is greater than plus or minus .001" on the dial, the part is rejected. Most important of all, the serrations can be checked over their entire length.

Two different models of this gage have been built. One permits gaging with the part in the grinding fixture — thus eliminating many costly rejects. The other serves as a final inspection gage.

This unit is typical of the hundreds of Taft-Peirce CompAIRators now simplifying complicated gaging operations. For more information on this and many other items, send for your copy of the Taft-Peirce Handbook.



STANDARD AND SPECIAL COMPAIRATORS | AIR ELECTRIC COMPAIRATORS | AUTOMATIC SORTING MACHINE | COMPUTING COMPAIRATORS

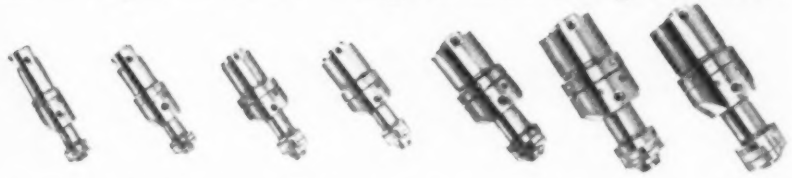
T-P means Top Precision

T P

THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, R. I.

how leading car, truck and trailer builders solve production riveting problems with Hannifin "HY-POWER" Hydraulics

1 They select the correct size "Hy-Power" Hydraulic Cylinders

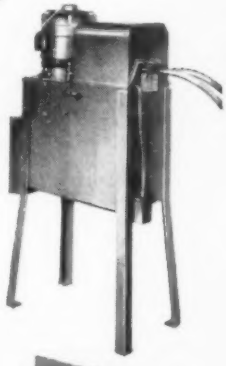


Hannifin supplies "Hy-Power" Hydraulic Cylinders in 7½ to 100-ton capacities (more in multiple) to exert the force exactly when and where you want it.

2 They mount the cylinders in Hannifin "C"-Frames

The "Hy-Power" line includes standard "C"-frames in a wide variety of sizes and types for portable or stationary use. Or, if your requirements are special, Hannifin will design and build "C"-frames to suit your needs.

3 Power source is the exclusive "Hy-Power" Pressure Generator



Here's Hannifin's patented, noiseless pressure generator. It's a compact unit that combines motor, pump, oil reservoir, control valves and high-pressure intensifier.

HANNIFIN "HY-POWER" RIVETING IS THE LONG-TIME STANDARD OF THE AUTOMOTIVE INDUSTRY

If you're looking for a better riveting method—whether you need one riveter or fifty—discuss it with your Hannifin representative. Meanwhile, get the full story by writing for Bulletin 150.

HANNIFIN

Air and Hydraulic Cylinders • Hydraulic Presses • Pneumatic Presses • "Hy-Power" Hydraulics • Air Control Valves

Hannifin Corporation, 519 South Wolf Road, Des Plaines, Illinois

NEW design freedom

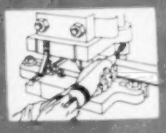
FEATURED IN THE EXPANDED DANLY DIE SET LINE

NOW Danly meets or beats all ASA standards . . .

with the world's broadest die set line. There's no need for compromise between the standard set you want and the set you can get, less need for costly specials. The new line of Danly Standard Die Sets has die space and guide post dimensions that equal, *or exceed*, ASA specifications. Under the new standards, front to back die space is measured *from edge of bushing to front of die set.*

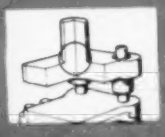
In addition to offering a complete selection of ASA standard die sets, Danly provides the Danly Standards proved popular over the years . . . all available from stock at your nearest Danly Branch. You can be sure of meeting all your die set needs at Danly . . . either ASA standard or Danly Standard.

NOW Danly offers you these additional features



Oil Lubrication System For Shoulder Bushing Sets. This new Danly die set feature assures longer life, easier maintenance, proper lubrication even during long runs.

All Horizontal Surfaces Ground On New Danly Die Sets. Horizontal surfaces, including top of punch holder and bottom of die holder, are ground to the same exacting precision as the inner die set surfaces.



Integral Welded Shanks. 100% weld on all-steel sets regularly furnished with shanks gives greater strength and rigidity. Deep counterbores in punch holder have less tendency to weaken set.

DANLY®

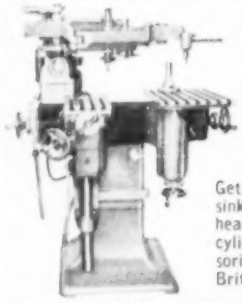
DIE SETS AND DIEMAKERS' SUPPLIES

DANLY MACHINE SPECIALTIES, INC.

2100 South Laramie Avenue, Chicago 50, Illinois.

ALEXANDER DIE-SINKERS

for 2 or 3 dimensional work



Latest model, No. 3A for molds and dies up to 1000 lbs. Ratios from 1.5:1 to 10:1, 14 spindle speeds from 475 to 9500 rpm, cutters up to 3/8" dia. Two smaller sizes, 1A and 2A.

Get a close look at Alexander engravers, die-sinkers, and cutter grinders—optical dividing head, centering and cutter grinder microscopes, cylinder roller attachments and other accessories. Write for catalog D on these quality, British machines.

J. ARTHUR DEAKIN & SON 150-28 HILLSIDE AVE. JAMAICA 32, N.Y.

USE READER SERVICE CARD; INDICATE A-12-250-1

DYKEM STEEL BLUE

Stops Losses making Dies and Templates

Popular package is 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

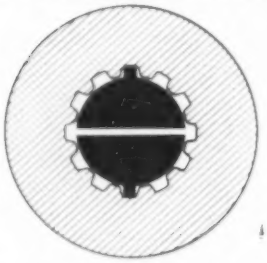
Write for sample on company letterhead

THE DYKEM COMPANY
2303D North 11th St. • St. Louis 6, Mo.

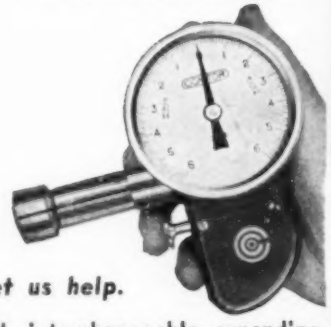
USE READER SERVICE CARD; INDICATE A-12-250-2

FOR GAGING SPLINE ROOTS

Both Odd and Even Tooth



With modifications standard Comtorplugs solve many spline gaging needs including pitch diameter or clearance.



State your problem - - let us help.

COMTORPLUG with interchangeable expanding plugs to gage simple or special bores from 1/8" to 8" dia.

UNIQUE ADVANTAGES

Positive gaging accuracy to fraction of .0001" regardless of who operates it.
Indicates actual size, a fixed—not passing—reading.
Positive 2-point gaging — automatic centering.
Shallow holes, deep holes, inside splines, open-end holes gaged easily.
Detects ovality, back or front taper, bell mouth, barrel shape.
Reaches to bottom of blind holes.
Gages work while still held in chuck.
A shop tool for all-day every day use.
Portable — no wires, hoses or stands.

Investigate the gage used by the thousands in jet engine, guided missile, farm machinery, automotive transmission, household appliance, and other volume-precision plants. IT MAKES PRECISION GAGING EASY . . . at machine . . . at inspection bench . . . for selective assembly. No other like it—investigate and see why.

COMTOR CO.
69 Farwell Street
Waltham 54,
Massachusetts

GET THE FULL FACTS — REQUEST BULLETIN 48
USE READER SERVICE CARD; INDICATE A-12-250-3

Tough grinding jobs? Check *Vulcanaire* high speed precision grinding heads!

Grinding circular slot using Vulcan's Rotary Table and Magnetic chuck.

Many seemingly impossible grinding problems have been solved by adapting Vulcanaire to standard machines or by using one of Vulcan's specially designed machines.

On Surface Grinders, merely remove wheel and guard, clamp vertical or horizontal adaptor to machine as illustrated. No belts necessary. For instance, Vulcanaire used in connection with Vulcan's Rotary Table for Surface Grinders permits the grinding of a circular slot.

Adaptors are in stock to fit the spindle of Vertical Milling Machines for grinding contours, holes and slots.

On Internal Grinding Machines Vulcanaire's infinitely controlled speeds furnish the correct surface cutting speed resulting in faster production and micro finish. The adaptor sleeve fits into present housing.

Applied to Jig Boring Machines, Vulcanaire is liked by leading precision manufacturers because its accuracy is guaranteed, producing Vulcanaire jig grinding of large and small parts.

Vertical adaptor for Surface Grinders. Grinding small slots

Send us a blue print on your toughest grinding problem. Recommendations and sketches will be returned to you — no obligation.

Horizontal application. Grinding a shoulder Punch.

Major Vulcan Services

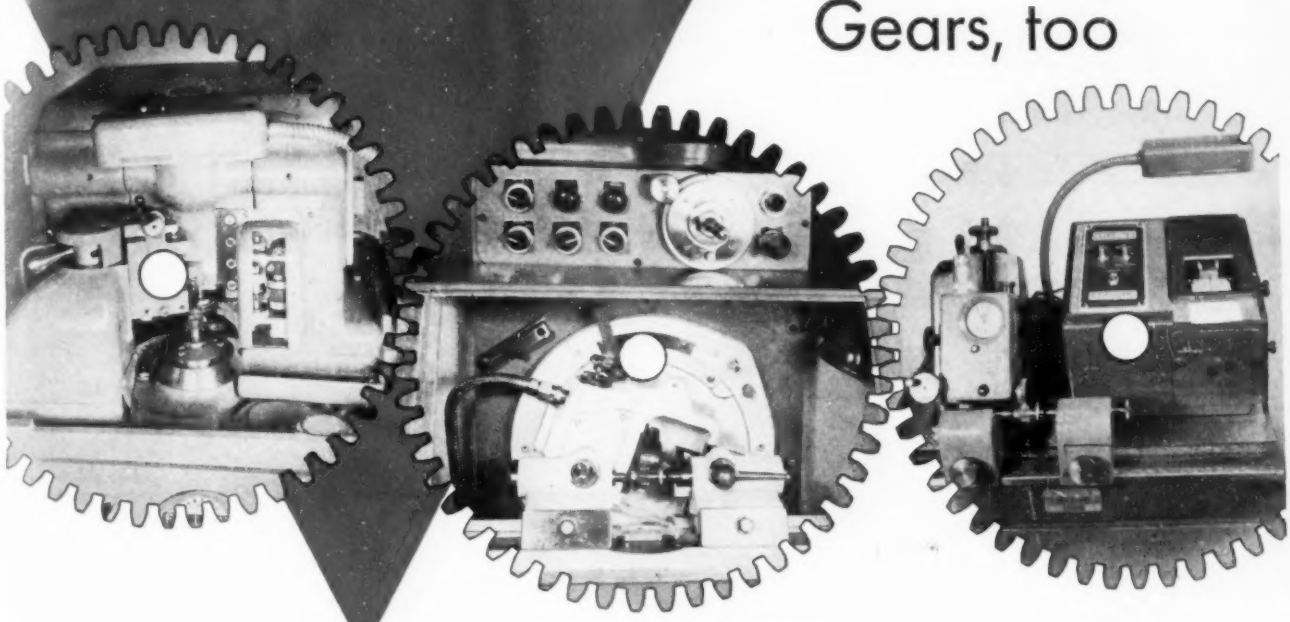
Engineering, Processing, Designing and Building... Special Tools... Dies . . . Special Machines . . . Vulcamatic Transfer Machines . . . Automation . . . including the Vulcan Hydraulics that Form, Pierce, Assemble and size. . . . Vulcanaire Jig Grinders . . . Motorized Rotary Tables . . . Plastic Tooling.

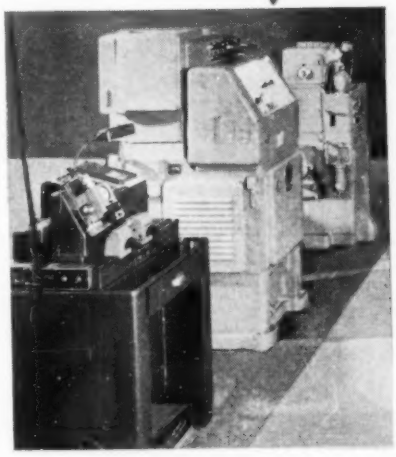
VULCAN TOOL CO.

7300 LORAIN AVENUE • DAYTON 10, OHIO

USE READER SERVICE CARD; INDICATE A-12-250-4

FULLY INTEGRATED PRODUCTION ... for Fine-Pitch Gears, too





AT THE NMTB SHOW gear men had the opportunity to see for themselves how quantity production of high-precision fine-pitch gears can be achieved at low cost. Using a Fellows 3-Inch Gear Shaper, No. 4 Gear Shaving Machine, and No. 4 Red Liner Inspection Instrument ... all fully integrated ... production speeds can be obtained that a short time ago were considered impractical.

Simultaneously, close tolerances can be assured which will meet the most exacting gear-train requirements for electronics and instrumentation.

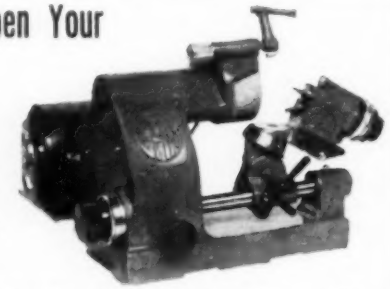
If you are interested in fine-pitch gears ... either as a producer or user, or both ... it will certainly pay you to get all the facts about the Fellows fully integrated line of equipment. WRITE, WIRE, or PHONE any Fellows Office.

THE FELLOWS GEAR SHAPER COMPANY,
78 River Street, Springfield, Vermont.
Branch Offices: 319 Fisher Building, Detroit 2
5835 West North Avenue, Chicago 39
2206 Empire State Building, New York 1
6214 West Manchester Avenue, Los Angeles 45

THE PRECISION LINE *Fellows* *Gear Production Equipment*

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-12 251

Precision Sharpen Your Die-Sinking Cutters on an ALEXANDER Bench Grinder!



Over 1,000 sold in United States

Also 2- and 3-dimensional pantograph engraving machines
Write for catalog D on these quality, British machines

J. ARTHUR DEAKIN & SON 150-28 HILLSIDE AVE. JAMAICA 32, N.Y.

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KEYLESS DRILL CHUCKS

SLIP-PROOF

STRONGEST CHUCK MADE

TRY ONE

K. O. LEE CO. ABERDEEN, S. D.

If it's made by **Lee** *it's a* **"Knock-Out"**

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HOGGSON SYMBOL STAMPS for PERMANENT CODING and QUALITY CONTROL

Control the job at every step with Hoggson special Symbol Stamps. Select designs from our wide stock, or let us help you design your own coding systems. 1/8" to 1/2" or to your specs. 144 stock symbols.

INSPECTORS' HAMMERS

Hoggson symbols are available in hammer form. For ease and rapidity of inspection control these hammers are extremely useful. All Hoggson marking devices are made of high strength alloy steel specially heat treated to stand up under long, hard use.

See your distributor or send for complete catalog

HOGGSON & PETTIS MFG. CO.
144 Brewery Street, New Haven 7, Conn.

USE READER SERVICE CARD; INDICATE A-12-252-3

low cost precision stamping *with* KENCO

1½ to 15 ton PUNCH PRESSES

Low cost because Kenco presses are quality-built *throughout* to produce at top speed, and with the least downtime you've ever experienced.

Precision stamping—a result of unusually rigid frames . . . extra long ram guides and slides that permit full use of the guiding area at the bottom of the stroke.

Send for full details on money-saving Kenco presses.

KENCO MANUFACTURING CO.
Mfrs. of Precision Machinery and Accessories.
5211-C TELEGRAPH ROAD, LOS ANGELES 22, CALIFORNIA

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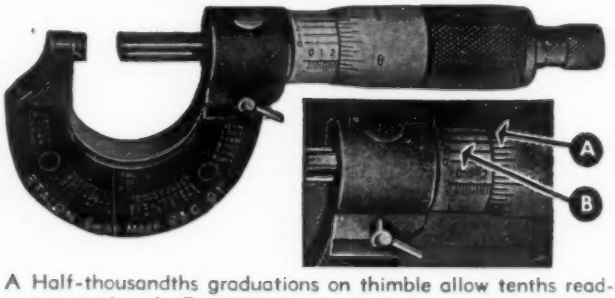
ETALON 23c

THE ONLY MICROMETER GRADUATED IN THOUSANDTHS AND HALF THOUSANDTHS OF AN INCH . . .

Reads to .0001 of an inch

ONE PIECE STAINLESS STEEL SPINDLE AND SCREW
Hardened and ground from the solid.



A Half-thousandths graduations on thimble allow tenths readings with only 5 vernier graduations.

B Deep, machine divided graduations on both thimble and barrel assure easy reading under most lighting conditions.

Forged Frame • Heavy Duty Tungsten Carbide measuring faces, optically lapped • Quick acting positive lock • Feather touch friction stop eliminates wear; assures sensitive "feel" • Dull chrome finish on thimble and barrel eliminates glare • In handsome contour case.

F.O.B. New York **$19.80**

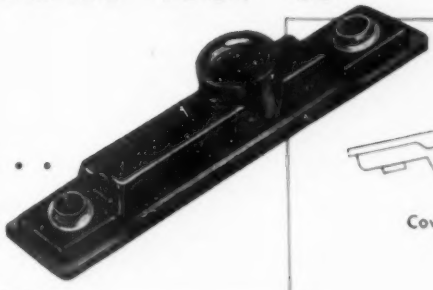
ASK YOUR DEALER or write:

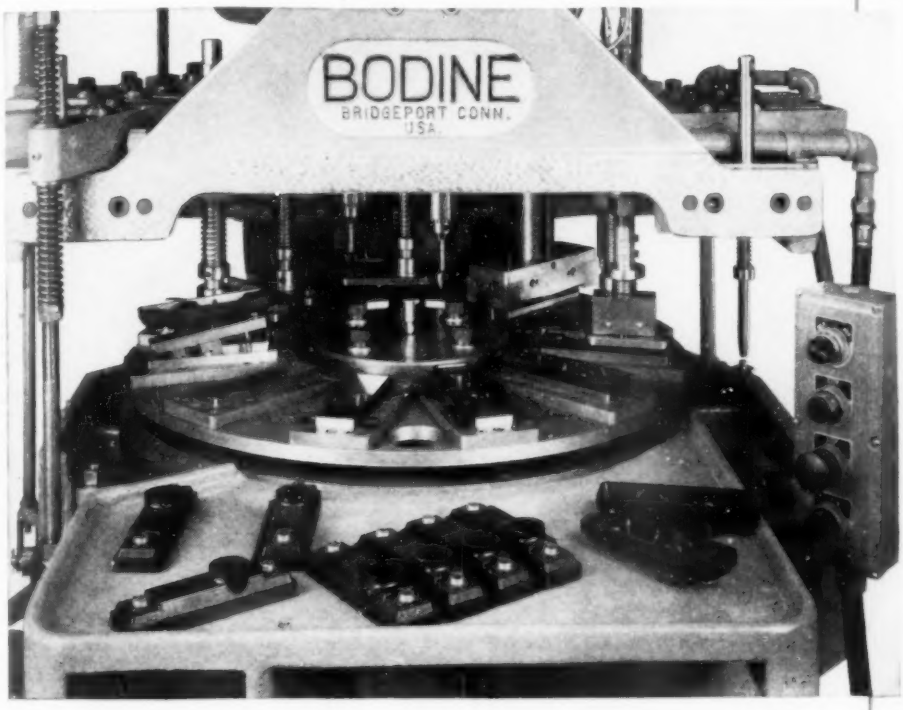
ALINA CORPORATION
401 Broadway • New York 13, N. Y.

USE READER SERVICE CARD; INDICATE A-12-252-5

Bodine CASE HISTORY NO. 41

MULTIPLE OPERATIONS . . .
MULTIPLE TOOLING . . .
METAL AND PLASTIC . . .
ON ONE VERSATILE MACHINE





The unusual features of this Bodine tooling lie in the many different types of operations performed in one high-speed cycle, and also in the multiple tooling of the machine to handle many different sizes of these auto battery cell covers, both 6-volt and 12-volt.

Major battery producers now use 15 of these production units. Bodine basic design, as will be seen in the photograph, provides ample room for inclusion of the dies required for trimming operations, as well as the rotary spindles.

PRODUCTION: 1,250 covers per 50-minute hour . . . with machine operating at 25 strokes per minute.

If you are looking for increased output at lower cost, without sacrifice of quality . . . on assembly or production operations, or a combination of both . . . talk to Bodine first. Our experience can save you money and costly engineering.

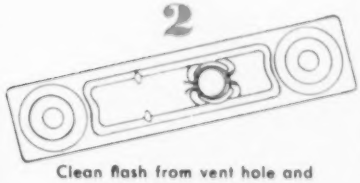
Write Dept. TE-12

78D55

1

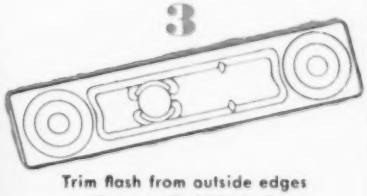
Covers hand-loaded, one piece per stroke.

2



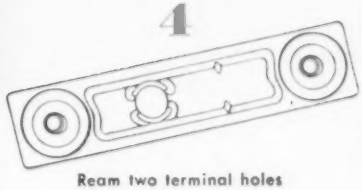
Clean flash from vent hole and slots. Carbide tools.

3



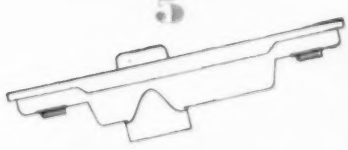
Trim flash from outside edges of cover. Carbide tools.

4



Ream two terminal holes in lead inserts.

5



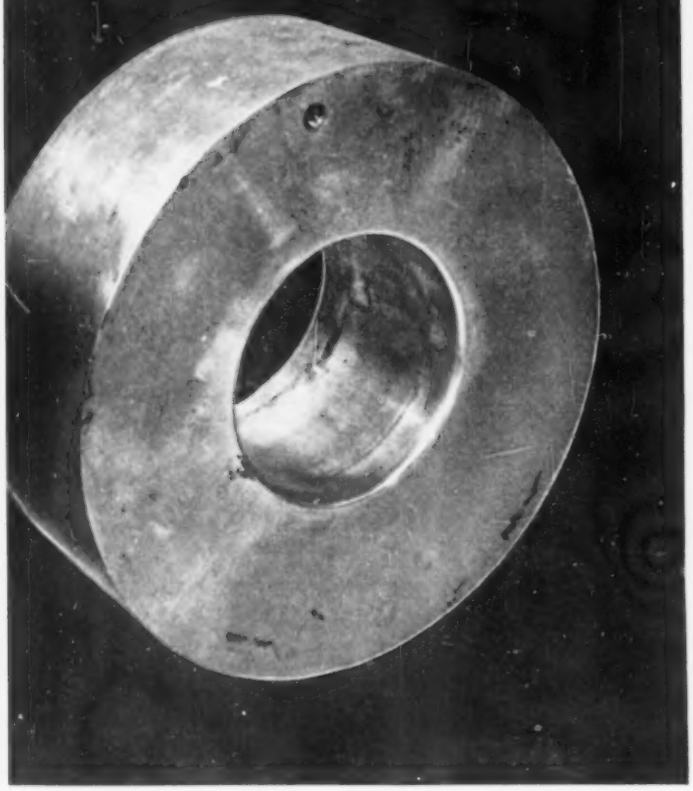
Hollow-mill two terminals in lead inserts . . . using inverted spindles.

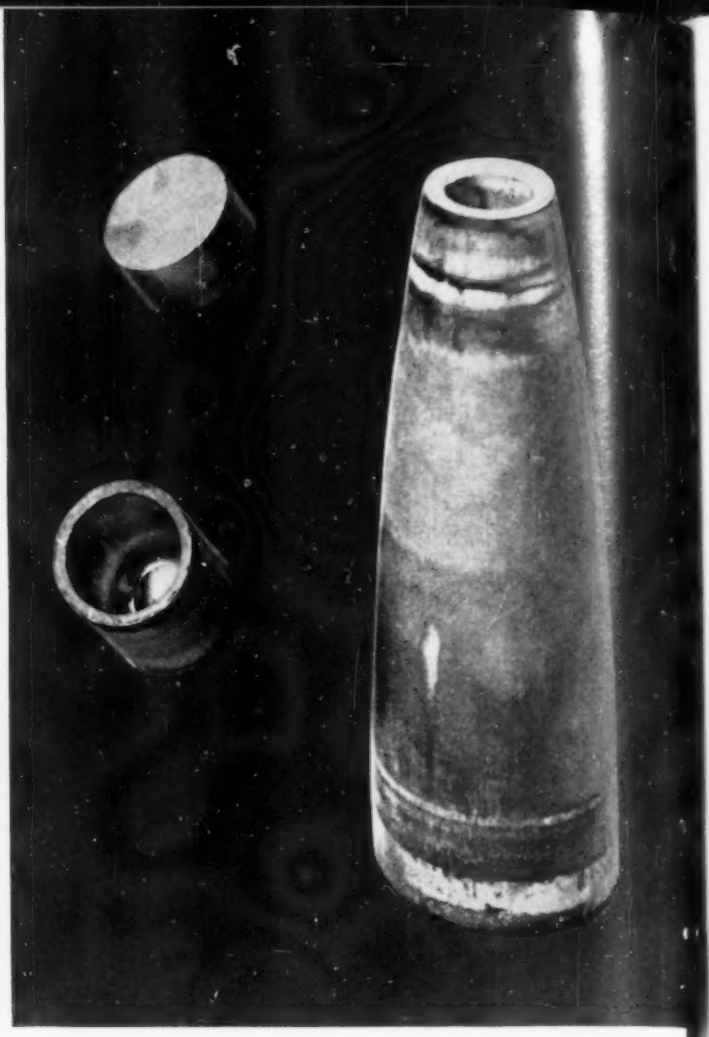
6

AUTO EJECT.

THE **Bodine** CORPORATION
BRIDGEPORT 5, CONNECTICUT
AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

FIELD REPORT: NO. 91





WHICH DIE STEEL WOULD YOU USE HERE to increase production from 100 to 23,000 parts?

Even after trying many different die steels, production averaged only about 100 pieces before this ring die had to be replaced.

The die cold forms cups as the first operation in producing rocket projectile noses from SAE 1010 Steel. Even though the ring die is press fitted into a four foot diameter hardened retainer ring (Rc. 34/36), the 1700 tons of pressure exerted in power extrusion prematurely stretches the die. The 12 lb. 2 oz. cups must be held within .2 of a lb. and wall thickness within .010".

Which die steel would you specify in a move to cut replacement costs and improve production?

From our customer Field Report files, here's how the toolroom solved the problem. The Carpenter Matched Set Method showed that Carpenter VEGA (Air-Tough) Die Steel was a natural for the job. Latest report shows that the VEGA ring die had increased production from 100 to 23,000 cups, and is still banging them out.

What better guarantee of success can you find for your own jobs than the word of hundreds of toolroom men who rely on Carpenter. Why settle for "ordinary" results when Carpenter is ready to help you explore the possibility for improvement? Call your nearest Carpenter Mill-Branch Warehouse, Office or Distributor now. *The Carpenter Steel Co., 154 W. Bern St., Reading, Pa.*

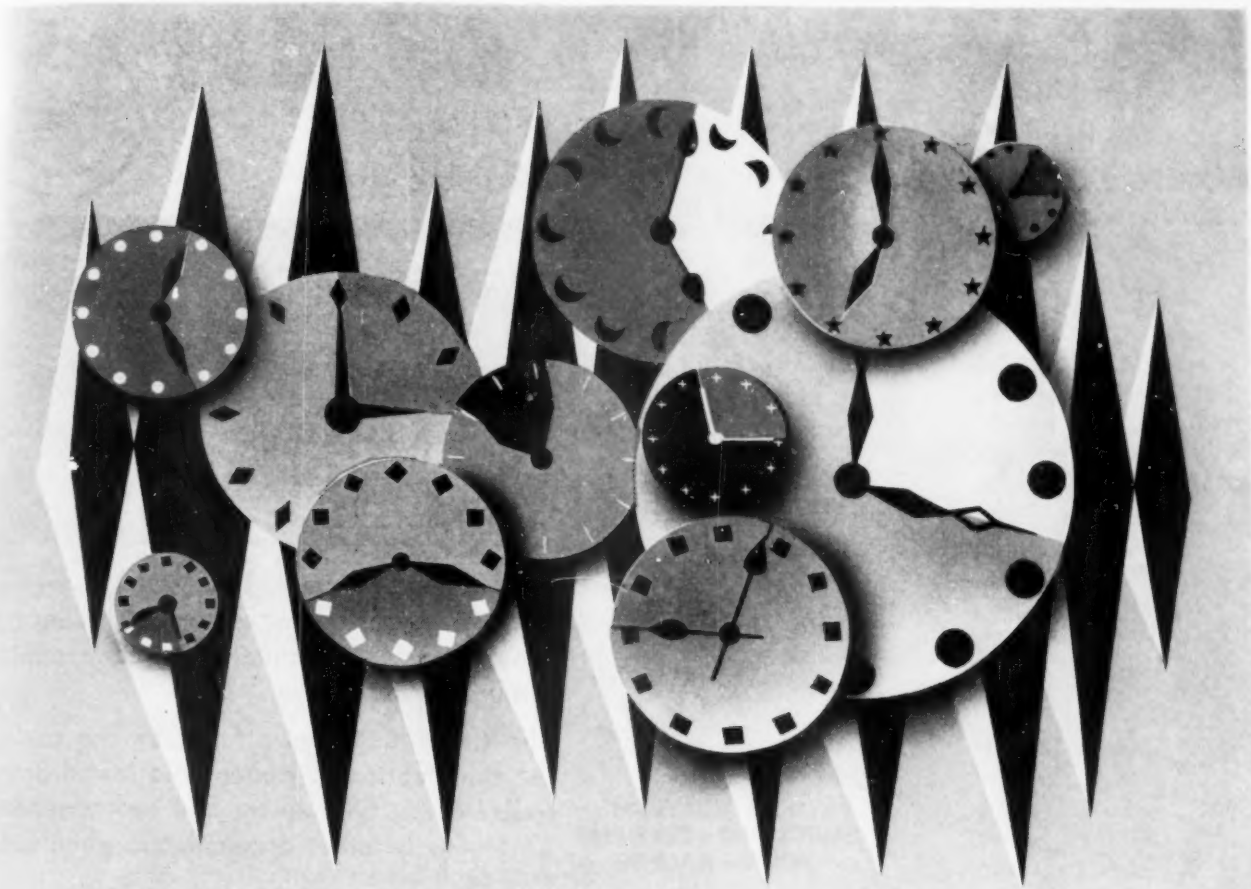
How can <u>your</u> toolroom use Carpenter Matched Tool and Die Steels to:

Reduce hardening hazards
Minimize machine downtime
Boost output per grind
Improve product quality

Carpenter STEEL

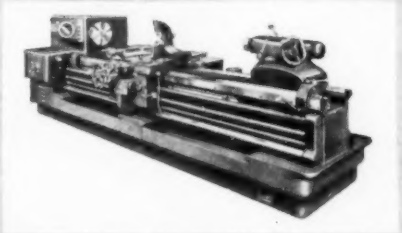
Matched Tool and Die Steels

IMMEDIATE DELIVERY from local warehouse stocks — Export Address: Port Washington, N. Y. — "CARSTEELCO"



"beat the clock"— is no game

"Beat the Clock," a famous television program, has become a popular home party game. But industrialists know that getting the most out of every hour on the time clock is no game, but a serious competition for business survival. The answer is not one of getting tough and bearing down harder. It's a problem, rather, of providing equipment that permits a man to work at a higher standard of productivity. When it comes to lathe work, that's an Axelson—a lathe with honesty in its design and integrity in its construction. Call or write us. We'd like to drop in and tell you about it.



AXELSON LATHES

make man hours mean more

AXELSON MANUFACTURING COMPANY

DIVISION OF U. S. INDUSTRIES, INC.

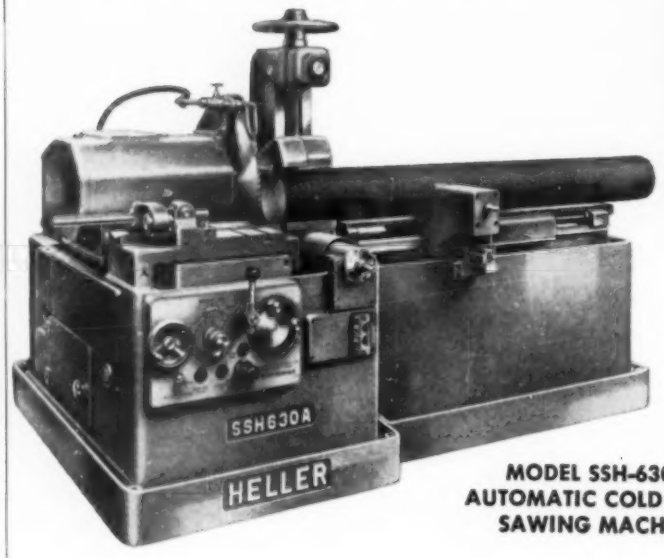
6160 S. BOYLE AVENUE, LOS ANGELES 58, CALIFORNIA

Dealers in Principal Tool Centers of the U. S.

TRIPLE ECONOMY WITH HELLER SAWING OPERATIONS

WHEN YOU HAVE ALL THREE UNITS FROM ONE SOURCE

1 THE COLD SAW



MODEL SSH-630-A AUTOMATIC COLD METAL SAWING MACHINE

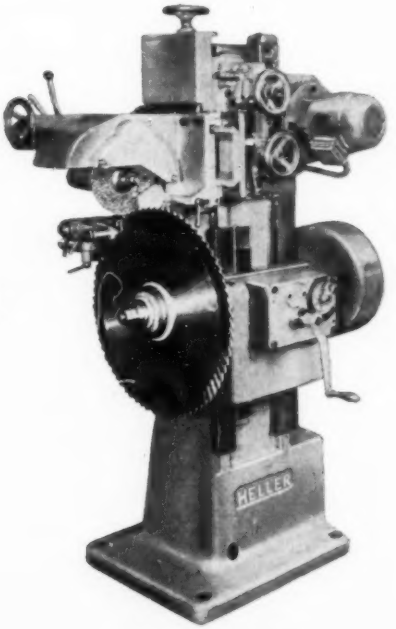
TRIPLE ECONOMY *with* HELLER

1. **The Cold Sawing Machine**
2. **The Blade Sharpener**
3. **The Circular Sawblade**

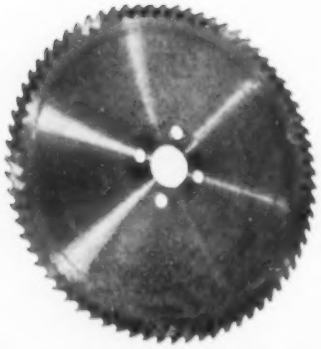
Economies are effected on every operation involved in cold metal sawing by taking advantage of the complete service available through Heller.

The specific savings offered by the use of the combination of Heller Cold Metal Saws, Heller Blade Sharpeners and recommended Sawblades becomes accumulative when used with each other.

2 THE SAW SHARPENER



MODEL B-650 AUTOMATIC SAW SHARPENING MACHINE



HELLER GIVES YOU COMPLETE SERVICE WITH EXACTLY CORRECT BLADES.

3 THE SAW BLADE

HELLER MACHINE COMPANY, 114 Liberty St., New York 6, N. Y.

KNEE AND PLANER TYPE MILLING MACHINES • RADIAL AND COLUMN DRILLING MACHINES • TRANSFER MACHINES • SPECIAL MACHINES

o. 6 in a series

You get demonstration of your work and complete job development record

Cone submits samples of your work

Cone makes recommendations

You send print to Cone

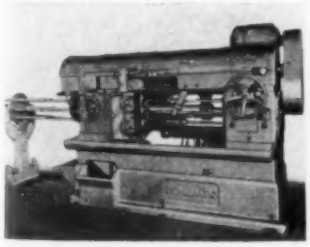
There is no adequate compromise with efficient production practices, if you are in business for a profit.

But you don't always know just how competitively efficient your equipment is. Case histories of what the other fellow is doing are sometimes garbled. At least the poor ones are not advertised. And conditions vary in all plants. Sometimes you have reason to be more concerned with what you don't want in new equipment than with what you do want. Cone believes too much is at stake for a machine to go into a line unequipped for the job, with either carbide or hss tools.

The Conomatic Carbide Development treats each job individually from standpoint of work, machine, tools, and operating personnel.

DATA FOR COMPARISON

Part	Bushing	Length	5/8"
Machine	1 5/8" Conomatic	Hole Dia.	1 1/4"
Tools	100% Carbide Tipped	RPM	825
Material	8620	Time	14.8 Secs.
Stock Size	1 3/8"		



Conomatic

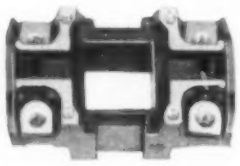
For particulars send for "Four Steps With Cone"

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U.S.A.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-12-257

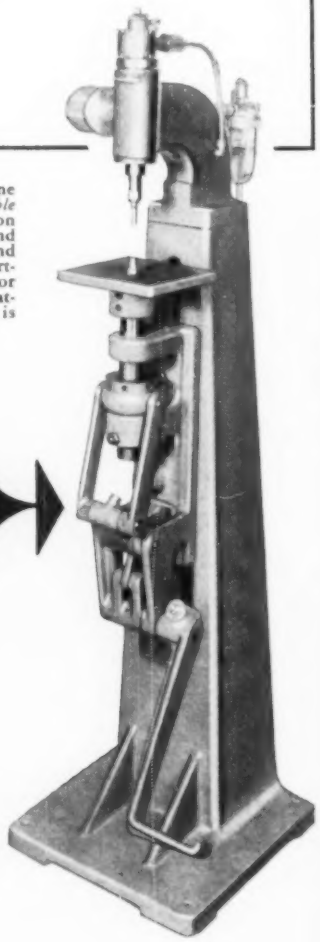
THE ANSWER
to some difficult
RIVETING PROBLEMS

For Example:



The manufacturer of this fragile molded terminal block was unable to rivet the metal inserts until the HILL RIVETER eliminated breakage with a timed cycle of 3 seconds and controlled light blows at 10 psi.

This air-operated riveting machine produces *accurately controllable* results that cannot be obtained on ordinary machines. It is fast and efficient, extremely versatile, and easily adaptable for either short-run or mass-production jobs. For regular solid riveting, it is unbeatable; for difficult problems, it is *The* Answer.



THE HILL PNEUMATIC RIVETING MACHINE

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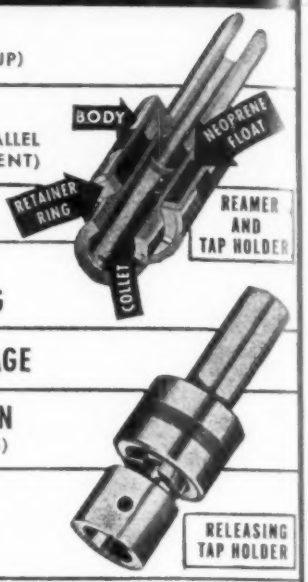

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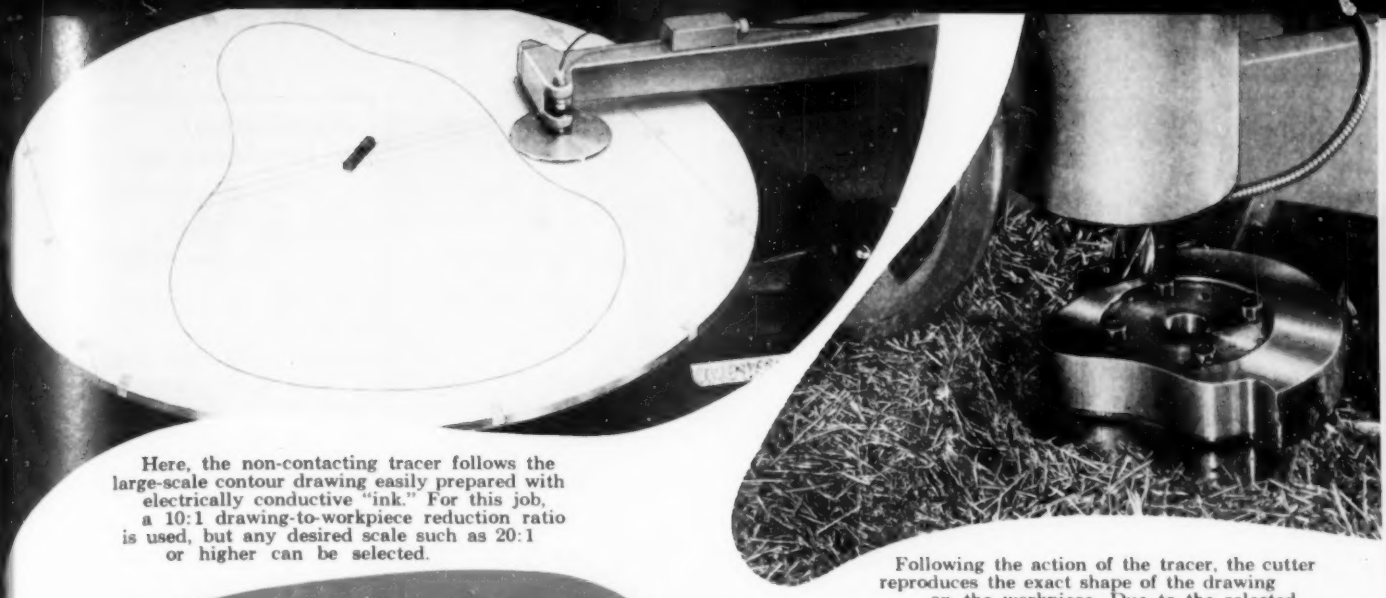

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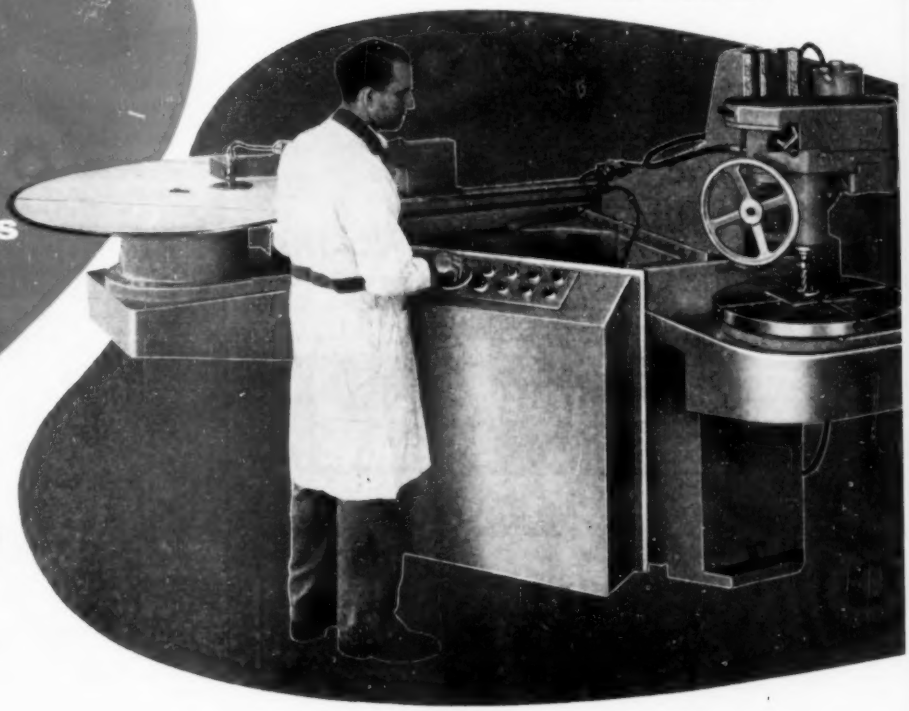

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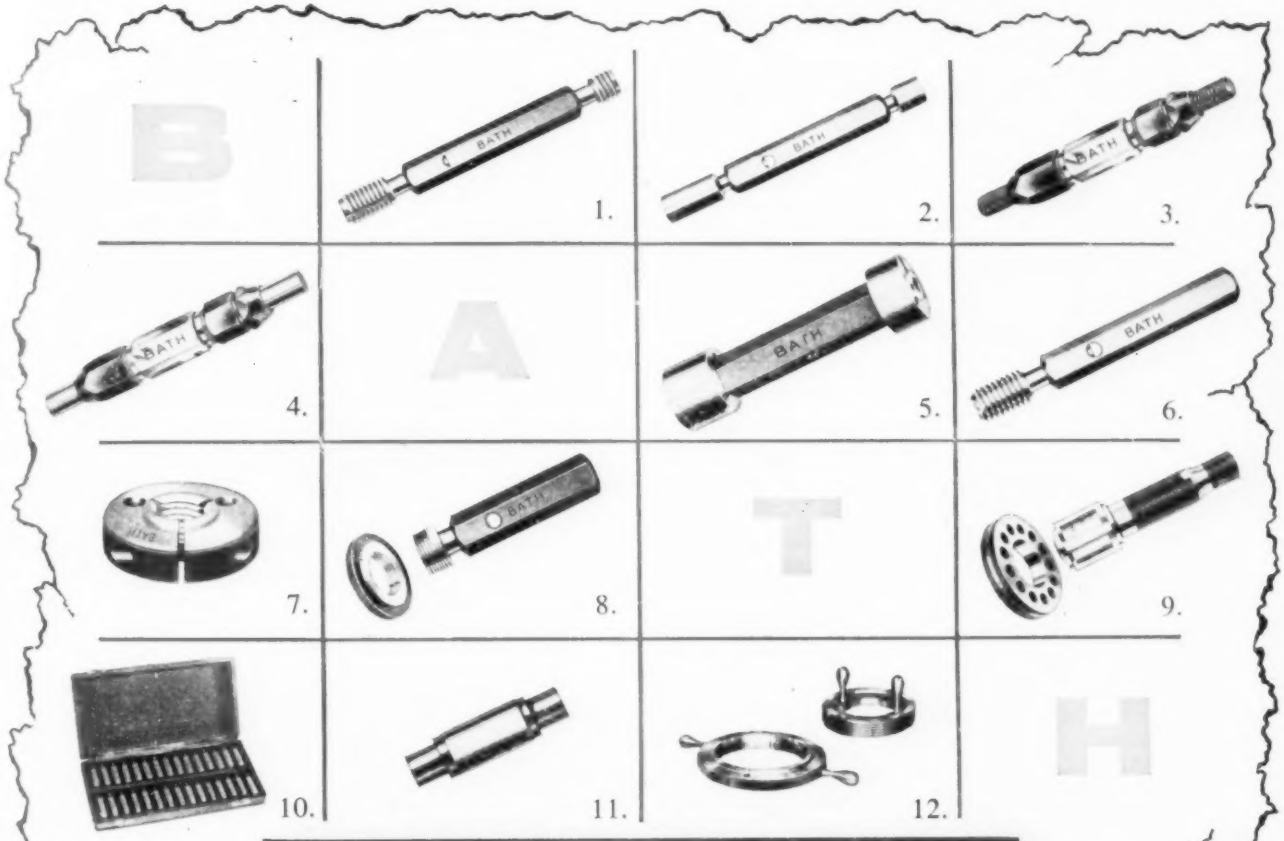

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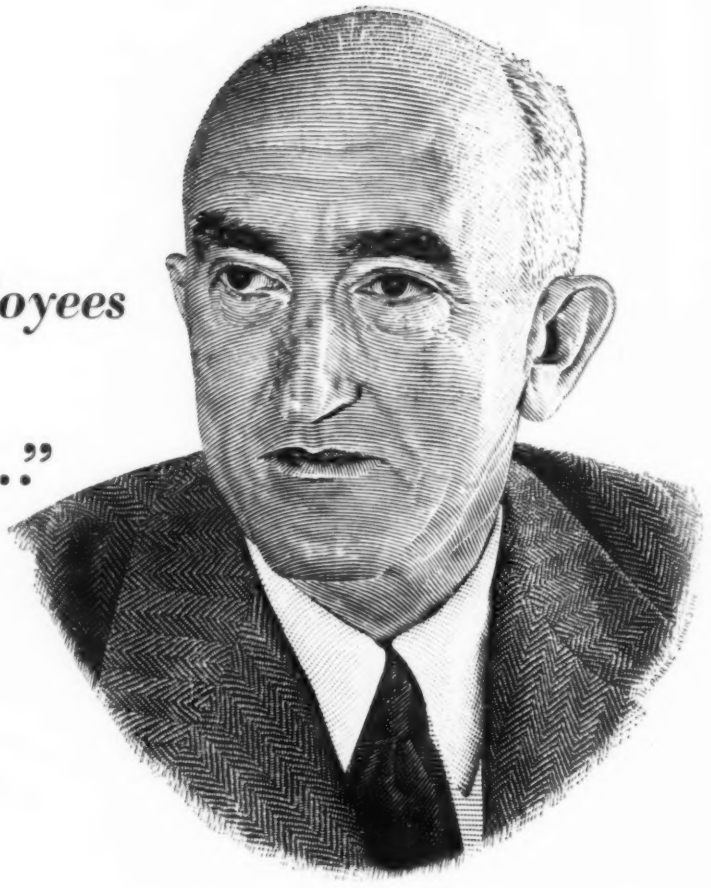

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This method required a whole minute and failed to provide uniform results. In addition, paint damage and broken drills caused excess time loss.

AIRengineering by Ingersoll-Rand solved the problem fast. A size AR130 Air Buck Riveter was equipped with special yoke, punches and stripping mechanisms. The holes are now punched four times faster, with closer tolerances and only *one* man is required instead of two.

If you are in a position to encourage cost-savings in your plant, you should see I-R's confidential manual reports on "AIRengineering at Work". Write on your company letterhead and we'll arrange for you to see it soon.

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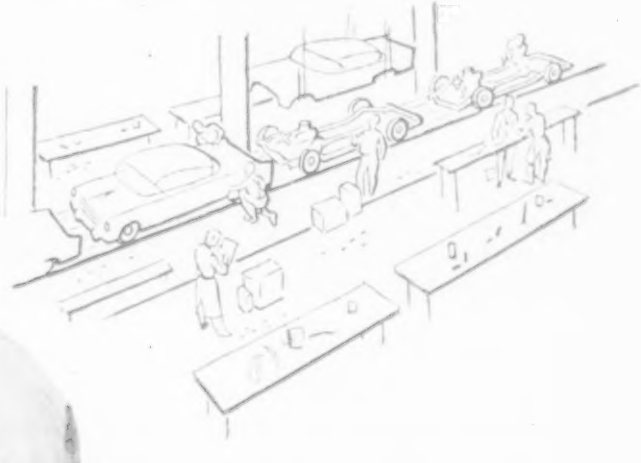

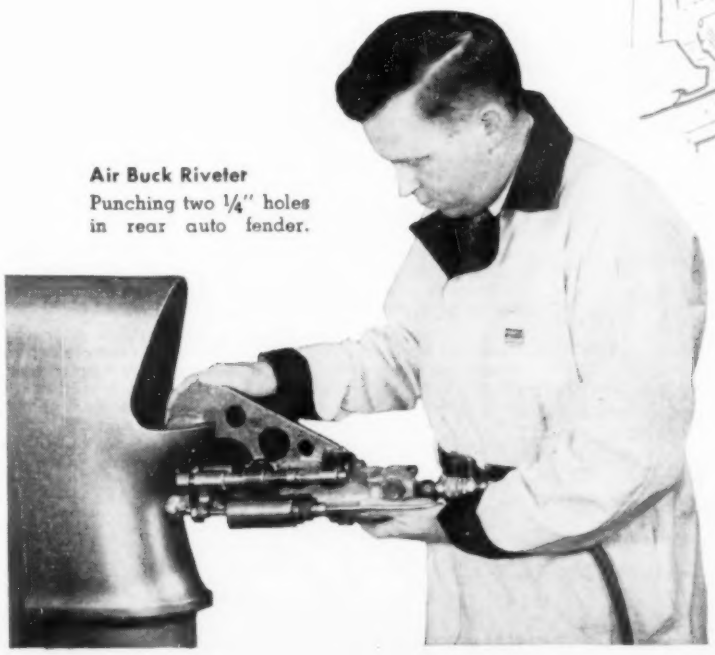

Air Buck Riveter
Punching two 1/4" holes in rear auto fender.

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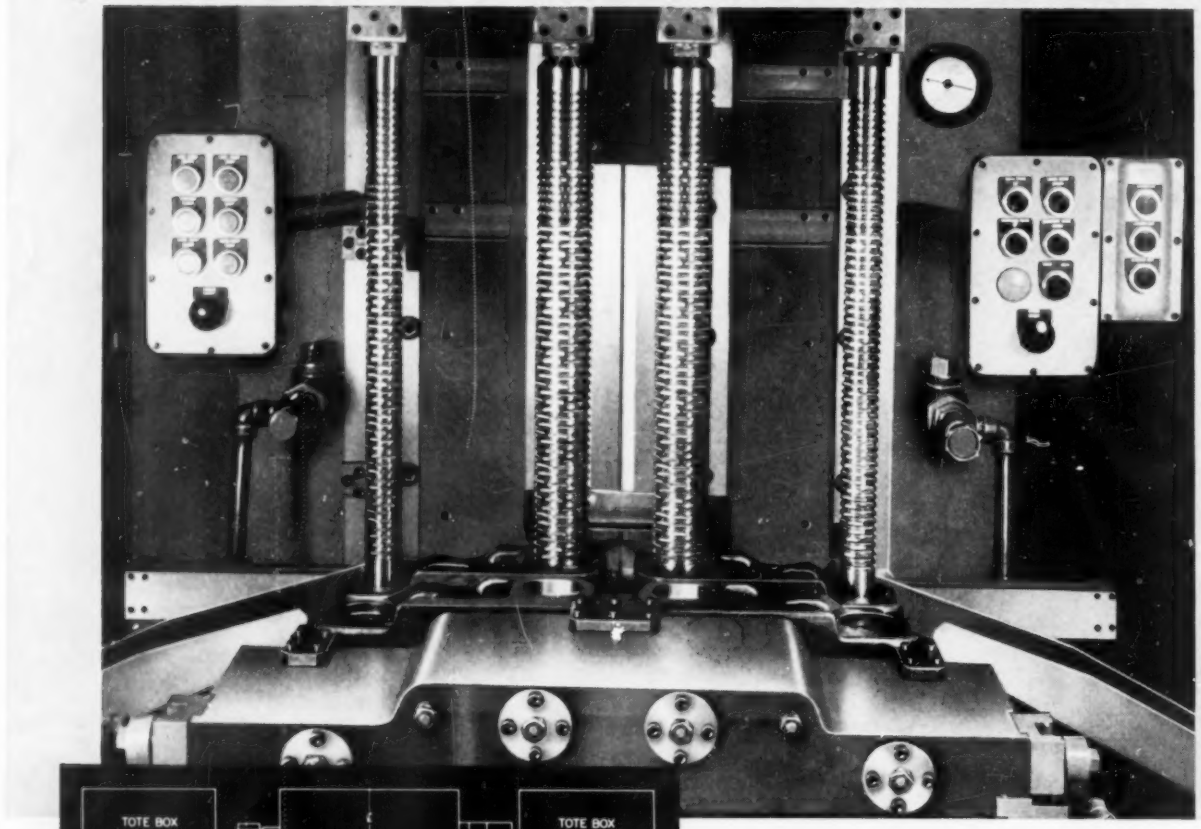
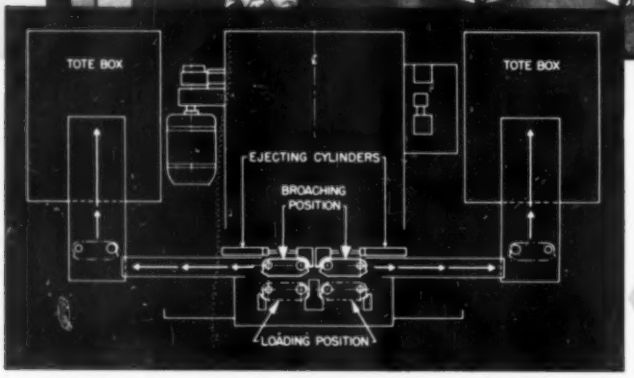
DETROIT BROACH PULL DOWN MACHINE BROACHES FOUR HOLES IN SIDE BARS





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The parts are alloy steel forgings, core drilled prior to broaching. The broaching operation finishes the holes and corrects hole location within .002" total tolerance. This accuracy is made possible by exclusive Detroit Broach Pull-Down design in which the tool handling slide gives rigid support to the broaches and follows them throughout their entire cutting stroke.

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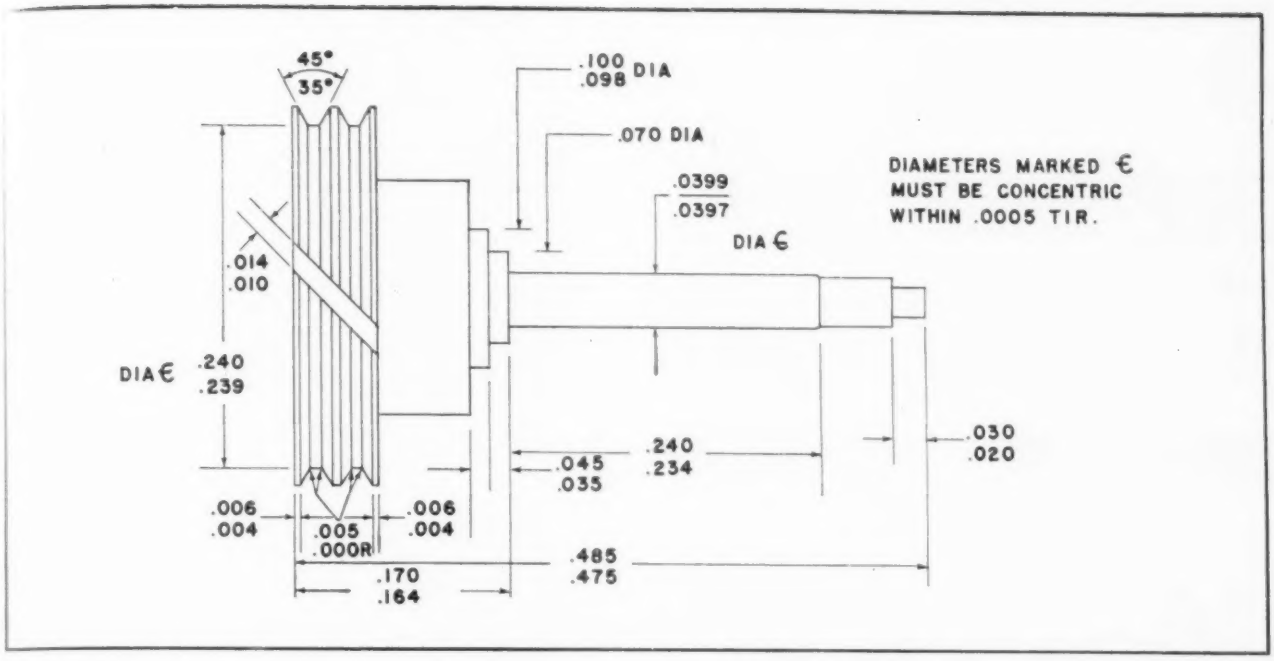

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The Tool Engineer

1955 Annual Index of Technical Articles

Volume XXXIV and XXXV

This annual index for the past twelve issues lists subjects treated in Technical Section as well as the Foreign Abstracts and Technical Digests departments. It is divided into two parts. The first is an alphabetical author's index listing article titles. The second part is a subject listing cross indexed for easy reference. Short items less than a page are indicated by an asterisk. Important subtopics are indexed along with major subjects. In this manner all references to a desired subject can be located.

Author Index

—A—

Abbott, Alfred K.—Efficient Control Cuts Crib and Tool Costs, Oct. p. 101
Adams, George C.—Plastic Models Cut Auto Body Development and Tooling Time by Surface Transfer Technique, Mar. p. 239
Allen, Arthur H.—Arc Welding for Small-Lot Production, Part 1, Cost Considerations, June p. 92
Arc Welding for Small-Lot Production, Part 2, Equipment and Processes, July p. 83
Arc Welding for Small-Lot Production, Part 3, Tooling the Job, Aug. p. 89
Aller, W. Fay—Setting Goals in Automation, Jun p. 104
Anderson, William V.—Carbide Mandrel Salvage*, Feb. p. 84
Andrews, Raymond O.—Repairing Bored Holes*, Apr. p. 77
Aronson, Charles N.—Hidden-Arc Welding Speeds Production, Nov. p. 95

—B—

Bay, Clinton A.—Automatic Riveting Leads to Precision, May p. 91
Begeman, M. L.—Unions for Engineers, June p. 103
Biddle, Fred D.—Guided Center-Punch*, Aug. p. 80
Bitner, H. D. and George Perkins—Fast Quench Reduces Heat Treat Distortion, June p. 108
Bizzoco, Thomas J.—Micrometer Gage*, Mar. p. 77
Practical Methods of Introducing Quality Control, Nov. p. 102
Blaker, John A.—Special Cutting Tools*, Aug. p. 79
Blatter, Alfred E.—Press Brake Design for Magnesium*, June p. 78
Bobbitt, L. H.—Die Opener, Dec. p. 78
Multiple Clamping Vise Jaws*, Feb. p. 84
Bohle, Fred—Selecting Effective Gear Inspection Methods, June p. 111
Bossmann, Cliff—Accurate Bushing Installation*, Apr. p. 76
Improved Processing Method*, Nov. p. 81
Quick-Acting Clamp*, June p. 76
Bovarnick, Bennett and W. B. Kennedy—Ceramic Tools Machine Steel Fast, June p. 71
Bower, C. T.—Locking Devices for Taper Shank Tools*, Feb. p. 85
Tandem Drill, Dec. p. 79
Boyd, John A.—Wet Machining of Cast Iron Increases Tool Life, June p. 81
Brown, Earle B.—Optical Truing of Lathes, Nov. p. 75
Burge, William G.—Welding Repair Prevents Costly Shutdown, Mar.

—C—

Calvert, Glen M.—Honing Techniques Control Size, Nov. p. 91
Carson, T. J.—Multiple Tool Grinding Setup*, Sept. p. 140
Catto, J. A.—Coding and Administration of Engineering Drawings, Apr. p. 118
Chace, Frank E.—Cutoff Device*, Aug. p. 79
Feed Stop for Progressive Dies*, Aug. p. 75
Trim Die Template Eliminated, Jan. p. 76
Chace, H. P.—Grinding, Lapping, Sept. p. 117
Colton, V. M.—Machine Development Program, Dec. p. 75
Cook, N. H., P. A. Smith and M. C. Shaw—Forces and Power in Metal Cutting, Sept. p. 143
Practical Application of Grinding Principles, Oct. p. 113
Putting Machinability Data to Work, Aug. p. 81
Crosby, Joseph P.—Broaching, Sept. p. 94

—D—

Daasch, F. J., S. L. Eisler and W. D. McHenry—Tool Life, Radiometric Methods Accelerate Testing, Apr. p. 79
Dahl, Hjalmar—Beading Devices*, Feb. p. 85
Drill Jig with Locating Device*, Oct. p. 83
Knockout for Forging Dies*, July p. 76
Production Washing Machine*, Apr. p. 78
Punch and Die for Assembling Oil Seals*, June p. 77
Davis, A. G.—Reducing Gage Costs with Standard Components, Aug. p. 101
Deardorff, C. E.—True Allowances Extend Production Tolerances, June p. 115
De Coursey, Henry—Precision Production of Small Parts, Mar. p. 79
De Illy, Attila—Mechanizing Press Operations in a Small Plant, July p. 113
de Ridder, E. J.—New Extrusion Techniques, Jan. p. 69
Delaney, R. J.—Press Brake Contours Aluminum Plate, Apr. p. 73
Delmonte, John—Epoxy Tools Have Wide Application, June p. 117
Doyle, L. E. and Ronald Lemon—Controlling Climate Effects, Dec. p. 113
Dutt Choudhury, Akshay P.—Automatic Milling Fixture*, Mar. p. 78

—E—

Egger, Ernest—Improved Broach Wear Strip*, Jan. p. 76
Special T-Nuts for Fixtures*, Mar. p. 76
Egy, W. L.—Optical Tooling, Apr. p. 86
Eisler, S. L., F. J. Daasch and W. D. McHenry—Tool Life, Radiometric Methods Accelerate Testing, Apr. p. 79
Eldridge, W. R.—Spacer Bushing for Uniform Centers*, May p. 78

Elmo, F. C.—Double-Action Clamp*, Apr. p. 76
Holder for Press Formed Part*, Oct. p. 84
Eshelman, Ralph H.—Numerical Machine Control Opens New Possibilities in Automation, Oct. p. 117
Opportunities in Tool Engineering, Mar. p. 71
Projection Welding . . . Growing Importance for Automatic Assembly, May p. 109

—F—

Forberger, Paul—Headstock Center as Driver*, Jan. p. 76

—G—

George, Henry—Hole Depth Gage*, Sept. p. 139
Gerber, H. J.—Auxiliary Boring Table*, Feb. p. 83
Grinding Wheel Gage*, Mar. p. 76
Notched Stop for Thin Strap, Dec. p. 80
Precision Centering Device*, June p. 76
Quick Acting Fixture Screw*, July p. 75
Repair Plug for Die*, Sept. p. 138
Socket Heads for Special Fasteners*, Aug. p. 78
Tailstock Alignment Tool*, Jan. p. 77
Toolholder for Undercuts*, May p. 80
Universal Self-Centering Drill Jig*, Nov. p. 79
Goodman, Glen S.—Quality Control for Automatic Screw Machine Production, Mar. p. 243
Grodzinski, Paul—Precision Lathe Cuts Threads on Faces, Jan. p. 90
Self-Truing Grinding Machine Compensates for Abrasive Removal*, Sept. p. 148
Gurnham, C. Fred—Reducing Expense of Waste Treatment, Mar. p. 248

—H—

Hale, Frank W.—Cam Machining without Master Former, Dec. p. 82
Hecker, Roland—Planing, Sept. p. 99
Henriksen, Erik K.—Clamped Chip Breakers, Their Advantages and Design, Mar. p. 103
Milling, Sept. p. 86
Herington, C. E.—Economical Tooling Gives Short Run Plastic Parts, Nov. p. 105
Hockett, Walter A.—How to Fabricate Plastic Faced Dies, Nov. p. 87
Hoftiezer, A. B.—Practical Noise Control, Mar. p. 250
Holland, Maurice—Dynamic Organization of Technical Information, Jan. p. 102

—J—

Johnson, Allen—Direct Adjusting Boring Toolholder*, Nov. p. 80
How to Choose Short-Run Cams for Automatic Screw Machines, May p. 81
Johnson, Stuart J.—How to Sharpen Hobs, Jan. p. 109

—K—

Kauffman, David C.—Company Standards Cut Cost of Carbides, June p. 83
Kellog, Charles T.—Grooving Tool Setup*, Oct. p. 82
Kennedy, W. B. and Bennett Bovarnick—Ceramic Tools Machine Steel Fast, June p. 71
Kitzmann, Paul—Small Feeler Gages*, May p. 80
Koslow, Henry—Progressive Riveting Dies*, July p. 73
Setup Indicator for Bar Stock*, Aug. p. 80
Setup for Turning V-Groove*, May p. 78
Special Tension Spring for Jigs and Fixtures*, Nov. p. 81
Kramer, Irvin R.—Frozen-Mercury Process Increases Scope of Investment Casting, May p. 106
Kronenberg, Max—Avoiding Tool Failures with Negative Rake, Jan. p. 83
Mathematical Methods of Production Planning*, Mar. p. 235

—L—

Laine, David—Die Castings for Machine Parts, June p. 79
Lane, W. A.—Increasing Job Shop Production With Carbides, July p. 77
Lemon, Ronald and L. E. Doyle—Controlling Climate Effects, Dec. p. 113
Levin, Samuel—Precision Drilling of Small Holes, Feb. p. 95
Lindunka, C. J.—Mechanical Presses, Sept. p. 127
Lucht, F. W.—Optimum Milling Speed Effects Production Economy, Oct. p. 92

—M—

Martin, Morgan and Robert S. Morrison—Matched Metal Dies for Fiberglass Reinforced Plastic Parts, July p. 109
McFadden, Charles A.—Carbide Tip Brazing, Feb. p. 115
McHenry, W. D., F. J. Daasch and S. L. Eisler—Tool Life, Radiometric Methods Accelerate Testing, Apr. p. 79
McIntire, H. O.—Investment Casting Techniques, Mar. p. 251
McKee, Robert E.—Training Tomorrow's Tool Engineers, July p. 69
Merriam, Richard—Surface Plates Compared by Physical Tests, Aug. p. 99

*Brief article less than 1 page.

Berryweather, G. E.—Circular Sawing, Sept. p. 114
Beyers, R. E.—Tool Engineering Solves Installation Problem, Dec. p. 91
Binetti, Al—Aluminum Contours Milled on Engine Lathe*, Apr. p. 92
Standard Gear Hobber Retooled for Difficult Tooth Form, Sept. p. 155
Boncrieff, A. D.—Developing Tooling for Gear Production, July p. 99
Boody, J. C.—How to Calibrate Surface Plates in the Plant, Oct. p. 85
Cooney, Clyde T.—How to Adjust Tolerance Charts, Oct. p. 75
Harrison, Robert S. and Morgan Martin—Matched Metal Dies for Fiberglass Reinforced Plastic Parts, July p. 109
Hueller, John A.—How to Select the Best Grinding Wheel, Feb. p. 91

—N—

Nelson, R. L.—Magnesium Tooling, Apr. p. 113
Niebel, B. W.—Work Sampling Gives Better Time Study Allowances, Nov. p. 115

—O—

Orr, Dale—Cam Action Heading Die*, Nov. p. 80
Oxford, Carl J., Jr.—Drilling Research Points to Production Improvements, Mar. p. 99

—P—

Pabst, Carl F.—Turning, Sept. p. 104
Palmer, Dwight and Robert Phillips—Training Engineers in a Small Organization, May p. 99
Papen, George W.—Training Engineers in a Large Organization, May p. 101
Paschkis, Victor—More Efficient Machining May Result from Temperature Research, May p. 105
Pelphrey, Harry—Roll Forming of Toothed Parts, Apr. p. 110
Pentesco, W. J.—Finishing Spherical Gages*, Apr. p. 77
Perkins, George and H. D. Bitner—Fast Quench Reduces Heat Treat Distortion, June p. 108
Pessl, Hubert J.—Draw Punch Failure Solves Production Puzzle, July p. 107
Phillips, Arthur L.—Low Heat Joining Saves Tools, May p. 85
Phillips, Robert and Dwight Palmer—Training Engineers in a Small Organization, May p. 99
Pickrell, L. and E. Tollefsen—Advancements in Tube Swaging Meet Design Challenge, Sept. p. 151
Potthoff, W. J. and E. A. Reed—Process Planning for Presswork Tooling, Jan. p. 95

—R—

Rea, Robert F.—Ceramics Prove Useful in Tooling, Mar. p. 95
Reed, E. A. and W. J. Potthoff—Process Planning for Presswork Tooling, Jan. p. 95
Retsema, Jay—Safety Control for a Cycling Press, Feb. p. 103
Reynolds, H. L.—Hydraulic Presses, Sept. p. 133
Rigeman, George H.—Beating Production Deadlines with Plastic Draw Dies, Sept. p. 141
Roberts, George A.—Water Hardening Tool Steels, Feb. p. 87
Robie, N. P. and A. D. Stover—Grinding High Speed Steels with Resin Bonded Wheels, Dec. p. 88
Romine, Ernest H.—Leadscrew Pilot for Acme Tapping Mar. p. 81
Rose, Arnold S.—Fabricating Titanium Components, Mar. p. 241

—S—

Saling, W. H.—Center Drilling Shafts*, July p. 74
Salts, Martin H.—How to Determine Assembly Tolerances, Feb. p. 105
Schafer, R. A.—Drilling, Reaming, Tapping, Sept. p. 111
Schlesinger, Klaus L.—Deburring Die*, Aug. p. 77
Schmidt, A. O.—Helical Carbide Cutters Broaden Scope of Milling, Aug. p. 87
Meeting Milling Requirements Under Shop Conditions, Nov. p. 82
Shaw, M. C., P. A. Smith and N. H. Cook—Forces and Power in Metal Cutting, Sept. p. 143
Practical Application of Grinding Principles, Oct. p. 113
Putting Machinability to Work, Aug. p. 81
Siekmann, H. Jack—How to Machine Titanium, Jan. p. 78
Silvagi, Joseph—Gears and Splines, Checking Pin Measurement Data, July p. 93
Sinram, F. W.—Gear Cutting, Finishing, Sept. p. 123
Smith, David N.—Parts Produced to Size by Automatic Quality Control, Aug. p. 73
Smith, P. A., M. C. Shaw and N. H. Cook—Forces and Power in Metal Cutting, Sept. p. 143
Practical Application of Grinding Principles, Oct. p. 113
Putting Machinability to Work, Aug. p. 81
Spicer, Charles—Safety Riveting Die*, Sept. p. 138
Spillett, R. F.—Tool Steels and Their Application, May p. 71
Stambaugh, Burnell C.—Power-Operated Nail Puller Saves Time and Effort, Sept. p. 160
Stine, Victor F.—Abrasive Selection in Blast Cleaning, Apr. p. 96
Stockwell, Arthur J.—Drill Jigs from Standard Structural Shapes, Nov. p. 107
Stover, A. D. and N. P. Robie—Grinding High Speed Steels with Resin Bonded Wheels, Dec. p. 88
Strasser, Federico—Inexpensive Drill Jig*, June p. 78
Method of Flattening Tubes*, Jan. p. 76
Principles of Correct Die Shank Location, Nov. p. 110
Triple-Action Combination Draw Die, Dec. p. 80
Sweet, Donald E.—Method for Determining Drill Size, June p. 119
Recessing Tool*, Aug. p. 77

—T—

Talamini, Louis A.—Tooling for Door Locks, Mar. p. 86
Thompson, W.—Boring, Sept. p. 108
Tollefsen, E. and L. Pickrell—Advancements in Tube Swaging Meet Design Challenge, Sept. p. 151

—W—

Wallace, C. F.—Long Milling Machine Controlled by Helical Cams*, Mar. p. 84
Wason, Robert A.—Automatic Hot-Test Stands, Nov. p. 117
Find Documents Easily with Unit Term Indexing, July p. 116
Finishes for Metals, Processes and Equipment, Aug. p. 111
Weber, W. W.—Arc Welder Installation, Feb. p. 112
Weller, E. J.—How to Apply Carbide Tooling to Automatics, Dec. p. 103
White, Dan—How to Inspect for Flaws with Penetrating Fluids, Oct. p. 107
Wilson, Robert—How to Apply Semiautomatic Submerged Arc Welding, Mar. p. 256
Winter, Otto W.—Shell Molding Equipment and Its Use, Apr. p. 103
Shell Molding, the Process and Its Possibilities, Feb. p. 73
Wojtowicz, Henry C.—Scissors-Type Gage*, Jan. p. 75

Subject Index

—A—

Abrasive blasting*, Feb. p. 102
Abrasive selection in blast cleaning, Apr. p. 96
Acme screw tapping, Mar. p. 81
Administration, saving on paperwork, Nov. p. 210, see also Management
Air compressor, motorless*, Aug. p. 96
Alignment, machine tools, optically, Nov. p. 75
Allowances, time study by work sampling, Nov. p. 115
Analysis of lapping process*, Aug. p. 168
Analysis, process, see Process Planning
Angle face turning*, June p. 89
Arc weld characteristics*, Jan. p. 199
Arc welder for large tanks, Feb. p. 112
Arc welding
  equipment and processes, July p. 83
  small lots, costs, June p. 92
  submerged*, Mar. p. 256
Assembly die*, May p. 79
Assembly tolerances determined statistically, Feb. p. 105
Atomic energy in industry*, Aug. p. 180
Atomic equipment production*, Oct. p. 110
Atomic safety instruments*, Apr. p. 204
Autofab, assembles printed circuits*, June p. 88
Automatic hot-test stands (engine), Nov. p. 117
Automatic materials handling, Nov. p. 199
Automatic milling machine*, July p. 90
Automatic operation
  arc welding, Feb. p. 112
  band sawing*, Feb. p. 110
  cam machining, Oct. p. 124; Dec. p.
  chrome plating*, Mar. p. 91
  cross-wire welding*, Dec. p. 111
  hobbing machine*, Feb. p. 98
  milling fixture*, Mar. p. 78
  press, Mar. p. 79
  press for small plant, July p. 113
  preventing stoppages*, Mar. p. 246
  quality control on lathe, Aug. p. 73
  sand mold measuring*, July p. 88
  turret lathe machining*, Nov. p. 100; Dec. p. 110
  welding, arc, July p. 85
  wire forming*, Sept. p. 157
  see also Mechanized
Automatic plating equipment*, Jan. p. 94
Automatic riveting, aircraft, May p. 91
Automatic screw feeder*, Sept. p. 146
Automatic screw machine parts, quality control*, Mar. p. 243
Automatic screw machines, choosing cams for, May p. 81
Automation, see also Automatic
  air gaging, Aug. p. 177
  blending viscous liquids*, Feb. p. 101
  capsuled*, Dec. p. 111
  designed for*, July p. 192
  down time*, Mar. p. 255
  electronic circuit assembly*, June p. 88
  employment*, Aug. p. 182
  engine plant, May p. 96
  engine testing, Nov. p. 117
  fly-wheel housing cover*, Mar. p. 91
  limits of, Jan. p. 191
  machine of standard elements, July p. 89
  planning for*, Oct. p. 204
  in production of pinion gears*, Oct. p. 116
  quality control of, Aug. p. 73
  requirements of machine tools for*, Mar. p. 240
  sectionized*, Jan. p. 106
  setting goals in, June p. 104
  tapping operation*, Feb. p. 108
  transfer machine design*, Apr. p. 218
  trends*, May p. 203
  see also: Automatic Operation Mechanized
Automation controls*, July p. 195
Automation and cranes*, June p. 201
Automation and obsolescence*, Oct. p. 210
Automation safety*, May p. 211
Auxiliary boring table*, Feb. p. 83
Avoiding tool failures with negative rake*, Feb. p. 90

—B—

Band sawing, remote control*, Feb. p. 110
Bar stock, straightening of*, June p. 189
Beading operation*, Feb. p. 85
Belleville spring*, Mar. p. 236

*Brief article less than 1 page.

Bending, hydraulic*, Aug. p. 94
Bevel gear design and standards*, May p. 195
Blast cleaning
abrasive selection, Apr. p. 96
sheet material*, Feb. p. 102
Bored holes, repairing*, Apr. p. 77
Boring
chatterless bars*, Jan. p. 87
precision*, June p. 100
Boring operation*, Oct. p. 112
Boring setup, auxiliary table*, Feb. p. 83
Boring toolholder, direct adjusting*, Nov. p. 80
Brake, for magnesium*, June p. 78
Brazing
determining silver alloy amount, July p. 119
porous metal*, May p. 104
titanium*, Aug. p. 86
Broach wear strip*, Jan. p. 76
Broaching
door locks, Mar. p. 86
endless chain machine*, Aug. p. 96
three planes*, July p. 92
Burring, die for*, Aug. p. 77
Bushing installation*, Apr. p. 76

—C—

Calibration of surface plates, Oct. p. 85
Cam machining, Oct. p. 124; Dec. p. 82
Cams for screw machines, May p. 81
Carbide, furnace for*, Sept. p. 159
Carbide grades, Jan. p. 117
Carbide machining, stainless*, Mar. p. 90
Carbide mandrel salvage*, Feb. p. 84
Carbide tip brazing, Feb. p. 115
Carbide tools, machining titanium, Jan. p. 80
Carbides
company standards for, June p. 83
grinding with CO_2 coolant*, Aug. p. 167
job shop use, July p. 77
tools for interrupted cut*, Dec. p.
Carbon dioxide coolant, grinding carbides*, Aug. p. 166
Cast iron, machining wet, June p. 81
Cast Mechanite compression molds for plastic parts, Nov. p. 105
Casting
aluminum from permanent molds*, Oct. p. 81
investment, frozen mercury, May p. 106
shell molding type, Feb. p. 73
Center drilling shafts*, July p. 74
Center-punch, guided*, Aug. p. 80
Centering device, precision*, June p. 76
Centers, spacer bushing for producing*, May p. 78
Ceramic tools, June p. 71; Dec. p. 121
Ceramics in Tooling, Mar. p. 95
Chemical metal cutting*, Nov. p. 90
Chip breakers
carbides, July p. 82
clamped, Mar. p. 103
Chucking, see Workholding
Clamp, quick-acting*, June p. 76
Clamping
double-action type*, Apr. p. 76
TV tube production*, Apr. p. 100
Cleaning metals, abrasive selection, Apr. p. 96
Coding engineering drawings, Apr. p. 118
Cold-forming titanium*, May p. 77
Cold rolled fillets and backup rolls*, Oct. p. 91
Communicating technical information, Apr. p. 211
Communications, airtube system*, July p. 115
Company standards, carbides, June p. 83
Comparator, camshaft, Jan. p. 92
Compressor, motorless type for air supply*, Aug. p. 96
Computers
digital*, Nov. p. 205
ordnance design*, Oct. p. 202
Conservation of diamonds*, Mar. p. 246
Contour cutting*, Dec. p. 112
Contour turning, mill rolls*, Nov. p. 99
Control, automatic with punched card for tape, Oct. p. 117
Control of machining operations with tolerance charts, Oct. p. 75
Controls
for automation*, July p. 195
production*, Jan. p. 196
safe for cycling press, Feb. p. 103
Conveyors, air hydraulic, for finishing, Feb. p. 117
Coolant, in machining cast iron, June p. 81
Coolants, wax type*, Feb. p. 200
Cooling, grinding operation*, Apr. p. 101
Corrosion control*, Jan. p. 200
Corrosion prevention*, Mar. p. 235
Costs, machining, Aug. p. 84
Cranes, in automation lines*, June p. 201
Creative design*, Oct. p. 211
Crib operation, Cadillac Motor Div., GM, Oct. p. 101
Cross-wire welding, May p. 112, Dec. p. 111
Cutoff device*, Aug. p. 78
Cutting feeds, see Feeds and Machining
Cutting fluids, see Coolants, Cutting oil
Cutting force measurements, Sept. p. 143
Cutting oil, in machining of cast iron, June p. 81
Cutting speeds, see Machining and Speeds
Cutting tools
carbide for automatics, Dec. p. 103
ceramic, Mar. p. 95; June p. 71; Dec. p. 121
cutoff*, Aug. p. 78
helical carbide for milling, Aug. p. 87
standardization of carbides, June p. 83
Cybernetics control*, July p. 195

—D—

Deep drawing*, Feb. p. 109
Depth gage, hole*, Sept. p. 139
Design
creative methods*, Oct. p. 211
industrial*, June p. 196
Design and surface finish*, Jan. p. 173
Design use of computers*, Oct. p. 202
Determining drill size, June p. 119
Determining silver alloy brazing wire dimensions, July p. 119
Development laboratory, gear production, July p. 99
Development of tools for gear production*, Nov. p. 86
Device lifts drawings*, Oct. p. 106
Diamond tools, development of*, July p. 180
Diamond wheel care, May p. 94
Die accessories
die opener*, Dec. p. 110
forging knockout, July p. 76
making trim type without template*, Jan. p. 75
progressive feed stop*, July p. 74
progressing riveting*, July p. 73
stop for thin stock*, Dec. p. 80
see also Dies
Die casting, draft, Aug. p. 121
Die casting machine parts, June p. 79
Die castings, production tolerances, May p. 119
Die design
assembly die*, May p. 79
combination cam type, Apr. p. 83
stop for thin stock*, Dec. p. 80
triple-acting combination die*, Dec. p. 81
see also Dies
Die and gage making, hollow stock use, Nov. p. 114
Die making, plastic faced type, Nov. p. 87
Die and punch for seal assembly*, June p. 77
Die opener*, Dec. p. 78
Die repair, welding, Mar. p. 92
Die sinking*, Aug. p. 109
Die steels, June p. 97
Die stock interchangeability*, Mar. p. 109
Dies
cam action heading*, Nov. p. 80
combination cam for high production, Apr. p. 83
deburring*, Aug. p. 77
extrusion, Jan. p. 70
for fiberglass reinforced plastic parts, July p. 109
forging-extrusion, Jan. p. 72
plastic draw*, Jan. p. 107
plastic draw type, Sept. p. 141
repair plug for*, Sept. p. 138
safety riveting type*, Sept. p. 138
seal assembly*, June p. 77
shank location, Nov. p. 110
see also: Die Design
Die Accessories
Dimensional control by tolerance charts, Oct. p. 75
Disk spring research*, Mar. p. 236
Dispatch service, air tube system*, July p. 115
Double-action clamp*, Apr. p. 76
Draft requirements, die casting, Aug. p. 121
Draw punch failure, July p. 107
Drawings, protected by drawer device*, Oct. p. 106
Drill, tandem, Dec. p. 79
Drill jig
center holes in shaft*, July p. 74
locating*, Oct. p. 83
self-centering*, Nov. p. 79
from standard structural shapes, Nov. p. 107
wedge type*, June p. 78
Drilling
precision small holes, Feb. p. 95
rectangular holes*, May p. 196
Drilling research, Mar. p. 99
Drilling and tapping multispindle special machine*, Oct. p. 98
Drills, determining size of, June p. 119
Drive, machine, see Machine Drive
Drop hammer vibration*, June p. 188

—E—

Education, tool engineers, July p. 69
Electron microscope, June p. 188; Aug. p. 167*
Electronic data handling machines*, Nov. p. 205
Employment, and automation*, Aug. p. 182
Energy, atomic for industry*, Aug. p. 180
Engineering
communications, Dec. p. 197
educational goals*, Dec. p. 199
future of, June p. 193
leadership responsibilities*, Aug. p. 178
organization for tool, Oct. p. 201
Engineering curriculum, production option, July, p. 70
Engineering drawings, coding and administering, Apr. p. 118
Engineering education*, Jan. p. 192
Engineering organization, Feb. p. 197
Engineering training
large company, May p. 101
small company, May p. 99
see also Training Engineers
Engineers, upgrading of, July p. 191
Engineers and unionization, June p. 103
Epoxy tool applications, June p. 117
Equipment, see Machine tools
Executive development, engineering*, Aug. p. 179
Experimental procedure*, Nov. p. 191
Extrusion press*, July p. 105

—F—

Fabricating titanium parts*, Mar. p. 241
Faceplate, vacuum type*, Feb. p. 100
Facing cuts*, June p. 89
Fast quench heat treat aluminum, June p. 108
Feed stop, progressive dies*, July p. 74
Feeds, knurling, Aug. p. 122
Feeds and speeds for stainless, Sept. p. 163
Feeler gages*, May p. 80
Filing information, unit term indexing, July p. 116
Fillet rolling in backup rolls*, Oct. p. 91
Finish grinding*, Apr. p. 101
Finishes, for metal products, Aug. p. 111
Fixture screw, quick-acting*, July p. 75
Fixtures
for automatic milling*, Mar. p. 78
special T-nuts for*, Mar. p. 76
special trunnion type for radial drilling*, Mar. p. 91
Fixtures and jigs, magnesium, Apr. p. 113
Flattening tubes*, Jan. p. 76
Flow meter for hydraulic press pump control*, Feb. p. 99
Flow spinning, jet engine parts*, July p. 102
Forces and power in metal cutting, Sept. p. 143
Forging-extrusion combination dies, Jan. p. 72
Forging, press USAF program*, Aug. p. 106
Forgings, trimming of*, June p. 102
Form grinding tappets*, May p. 89
Forming
press brake, Apr. p. 73
sheet metal, see Dies
Frozen-mercury investment casting, May p. 106
Function of organization*, Apr. p. 221
Future of engineering, June p. 193

—G—

Gage, hot strip by infrared radiation*, July p. 91
Gages
grinding wheel*, Mar. p. 76
micrometer type*, Mar. p. 77
scissors-type*, Jan. p. 75
small feeler type*, May p. 80
spherical*, Apr. p. 77
Gaging
air type for automation, Aug. p. 177
greater precision of*, Nov. p. 207
hole depth*, Sept. p. 139
standard components, Aug. p. 101
steel with X-ray*, Apr. p. 82
Gang sawing*, Nov. p. 81
Gang slitting, instrument steel*, July p. 104
Gear errors, Jan. p. 113
Gear hob sharpening, Jan. p. 109
Gear hobbing, tooling for, Sept. p. 155
Gear inspection methods, June p. 111
Gear production tool development*, Nov. p. 86
Gear and spline measurements, July p. 93
Gear tolerances, June p. 187
Gear train analysis*, May p. 194
Gears
checking pin measurements, Jan. p. 118
distortion from flame-hardening*, Jan. p. 172
electroplating*, Sept. p. 270
production of pinion type automated*, Oct. p. 116
spiroid type*, Oct. p. 205
German Machine Tool Show*, Nov. p. 189
Goals in engineering education*, Dec. p. 199
Grade-action curves in grinding, Feb. p. 92
Grades of tool steels, Feb. p. 87
Granite surface plates, physicals of, Aug. p. 99
Graphical methods for die-shank location, Nov p. 110
Grinding
application of principles, Oct. p. 113
automatic crankpin, Apr. p. 94
carbides, July p. 80
helical cutters*, Nov. p. 190
high speed steels, Dec. p. 88
selection of wheels, Feb. p. 91
titanium*, Jan. p. 194
use of high-frequency vibrations*, Dec. p 198
with CO_2 coolant*, Aug. p. 167
Grinding on jig borer*, Apr. p. 101
Grinding machine, self-truing*, Sept. p. 148
Grinding mill rolls*, Feb. p. 111
Grinding operation, coolant*, Apr. p. 101
Grinding setup, multiple tool*, Sept. p. 140
Grinding wheel gage*, Mar. p. 76
Grinding wheels
balancing*, June p. 188

*Brief article less than 1 page.

diamond type, maintenance, May p. 94
resin bonded, use of, Dec. p. 88
oving tool setup*, Oct. p. 82
ded center-punch*, Aug. p. 80

—H—

mmering machines*, Nov. p. 190
rdness, new concept of*, Sept. p. 271
ding die, cam action*, Nov. p. 80
adstock center as driver*, Jan. p. 76
at treating*, Aug. p. 108
eavy press program*, Aug. p. 107
elical cam control for milling machine*, Mar. p. 84
elical carbide cutters, milling, Aug. p. 87
idden-arc welding, Nov. p. 95
ob sharpening, Jan. p. 109
obbing, tooling gear hobber, Sept. p. 155
older, for press formed part*, Oct. p. 84
ollow spindles in special machine*, Jan. p. 91
oming techniques, Nov. p. 91
ot rolling mill minimizes down time, Jan. p. 88
ydraulic presses, Sept. p. 133
ydraulics, flow meter for press pump control*, Feb. p. 99
ydraulics, gasketing materials, Feb. p. 205

—I—

Indexing, unit term, July p. 116
Indexing technical information, Jan. p. 104
Indicator for setup of bar stock*, Aug. p. 80
Industrial change, flexibility of organization*, Nov. p. 206
Industrial design*, Mar. p. 237; June p. 196
Industrial diamonds, conservation of*, Mar. p. 246
Industrial hygiene*, Dec. p. 203
Industrial management, engineers in*, Nov. p. 201
Industrial organization*, June p. 200
Industrial research organization*, Feb. p. 191
Information organization, Jan. p. 102
Inspection
forgings*, Aug. p. 109
gear production, June p. 111
with penetrating fluids, Oct. p. 107
statistical methods*, May p. 196
Installation, plant equipment, see Machine tools
Installation, catapult equipment, Dec. p. 91
Instruments, optical tooling, Apr. p. 86
Investment casting, frozen-mercury process, May p. 106
Investment casting techniques*, Mar. p. 251

—J—

Jet engine compressor frame, machining*, Mar. p. 90
Jig
drilling*, June p. 78
for drilling with locating device*, Oct. p. 83
self-centering for drilling*, Nov. p. 79
Jig borer design, European*, Dec. p. 185
Jig boring machines*, Apr. p. 204
Jigs and fixtures
magnesium, Apr. p. 113
recessed screw and nut for*, Aug. p. 78
Jig design, from structural shapes, Nov. p. 107
Job shop production, increased with carbides, July p. 77

—K—

Knockout, forging dies*, July p. 76
Knurling feeds, Aug. p. 122

—L—

Lapping, analysis of*, Aug. p. 168
Lathe
automatic turret*, Nov. p. 100, Dec. p. 112
cuts threads on faces, Jan. p. 90
heavy-duty*, Apr. p. 93
tracer controlled*, July p. 106
Lathe adapted for large crankshafts*, July p. 103
Lathe for machinability research*, July p. 103
Lead screw pilot for Acme thread tapping, Mar. p. 81
Linear programming for production engineering*, Apr. p. 215
Lock production, Mar. p. 86
Locking devices, taper shanks*, Feb. p. 85
Low heat joining, May p. 85
Lubricant, for deep draw*, Feb. p. 109
Lubrication, gears*, Sept. p. 270

—M—

Machinability
computer*, Sept. p. 157
tool steels, etc*, Feb. p. 120
using data, Aug. p. 81
Machine, special has hollow spindles*, Jan. p. 91
Machine bearings, thermal expansion of*, Mar. p. 237
Machine capabilities, see Tolerances
Machine design
automation*, Apr. 218; July p. 193
conversion of crankshaft lathe to jet engine production*, July p. 98
jig borer*, Dec. p. 185
milling*, Apr. p. 204
press brake for magnesium*, June p. 78
thread rolling, June p. 90
transfer type, July p. 89
Machine development program, Dec. p. 75
Machine drive
dry fluid type*, May p. 89
variable speed, analysis*, Dec. p. 185
Machine tool, utility*, Apr. p. 203
Machine tool controls*, July p. 195
Machine tool design, automation*, Mar. p. 240
Machine tool processes, see Processes
Machine tools
alignment of optically, Nov. p. 75
development program, Dec. p. 75
improvement of*, Feb. p. 199
installation, Dec. 91
reducing radio interference of*, July p. 196
requirements of*, Nov. p. 203
Russian report on*, Dec. p. 186
special, see Special Machines
USSR*, May p. 195
Machining
cams, Oct. p. 124; Dec. p. 82
cast iron, June p. 81
with ceramic tools, June p. 71
Russian processes*, Dec. p. 187
temperature research, May p. 105
titanium, Jan. p. 78
see also Machining Operation
Machining compressor disks with converted crankshaft lathe*, July p. 98
Machining operation
automatic turret lathe*, Nov. p. 100; Dec. p. 112
boring*, Oct. p. 112
setup for V-groove*, May p. 78
Machining processes, tape controlled, Oct. p. 117
Magnesium tooling applications, Apr. p. 113
Magnetic tape, tri-dimensional*, Aug. p. 94
Maintenance, preventive, June p. 198
Management
administration of engineering drawings, Apr. p. 118
advances in engineering communications, Dec. p. 197
automation, June p. 104
communication of technical information, Apr. p. 211
executive training*, Dec. p. 200
future of engineering, June p. 193
goals of engineering education*, Dec. p. 199
materials, May p. 201
paperwork*, Nov. p. 210
tool engineers in, Mar. p. 71
use of quality control*, Apr. p. 222
workers' health*, Dec. p. 203
see also: Organization Training Engineers
Management engineers, effectiveness of*, Nov. p. 201
Materials
developing new*, July p. 199
die stock, Mar. p. 109
gasketing for hydraulics, Feb. p. 205
titanium, machining of, see Machining
tool steels, May p. 71
tooling, hollow bar stock, Nov. p. 114
vinyl plastics*, June p. 202
Materials control
proportioning system for mold sand*, July p. 88
in tool crib, Oct. p. 104
Materials handling
automatic, Nov. p. 199
conveyor system, Feb. p. 117
Materials management, May p. 201
Mathematical production planning*, Mar. p. 235
Mathematical statistics*, Apr. 204
Measurement, precision, Nov. p. 207
Mechanical presses, Sept. p. 127
Mechanized press line*, Mar. p. 85
Mechanized press operation, July p. 113
Mechanized torch cutting, Dec. p. 112
Metal arc welding, shielded*, Apr. p. 214
Metal cutting, chemical*, Nov. p. 90
Metal-cutting research*, Oct. p. 192
Metallurgical progress*, July p. 199
Metals, pressworking of*, June p. 205
Microdrilling, Feb. p. 96
Micrometer gage*, Mar. p. 77
Microscope, electron*, Aug. p. 167
Milan Tool Show, Mar. p. 236; Apr. p. 205
Military vehicle production*, Mar. p. 253
Mill, hot rolling, minimizes down time, Jan. p. 88
Mill shaving lead screws*, Feb. p. 189
Milling
airframe parts*, July p. 90
duplex machine*, Jan. p. 108
engine lathe*, Apr. p. 92
helical cam control*, Mar. p. 84
magnetic tape controlled*, Aug. p. 94
profile tooling for*, July p. 102
tape control of*, May p. 210
tests of cast cutters*, Jan. p. 171
vibration of end mills*, July p. 178
Milling cutter, special thread cutter*, Sept. p. 150
Milling cutters, helical carbide, Aug. p. 87
Milling fixture, automatic*, Mar. p. 78
Milling machine bearing tests*, Mar. p. 237
Milling machine design*, Apr. p. 204
Milling requirements for the shop, Nov. p. 82
Milling speeds, optimum, Oct. p. 92
Multiple clamping vise jaws*, Feb. p. 84
Multiple tooling for automatic turret lathe*, Nov. p. 100

—N—

Nail puller, Sept. p. 160
Needle cage*, Jan. p. 172
Negative back rake and tool failures, Jan. p. 83
New extrusion techniques, Jan. p. 69
Noise control*, Mar. p. 250
Nuclear power plant pilot model*, Oct. p. 208
Numbering, parts system, Apr. p. 118
Numbers, standardization of*, July p. 180
Numerical machine control, Oct. p. 117

—O—

Operation, machining, see Machining
Operation, press, see Press operation
Opportunities in tool engineering, Mar. p. 71
Optical tooling
catapult installation, Dec. p. 91
principles, Apr. p. 86
truing lathes, Nov. p. 75
Optimum milling speed and production economy, Oct. p. 92
Organization
engineering, Feb. p. 197
industrial*, June p. 200
industrial, flexibility of*, Nov. p. 206
manufacturing engineering, Oct. p. 201
Organization functioning*, Apr. p. 221
Organization of technical information, Jan. p. 102

—P—

Paperwork, saving on*, Nov. p. 210
Part holder, form and pierced die*, Oct. p. 84
Parts design, for production*, Nov. p. 209
Parts manufacture, die casting, June p. 79
Patterns, shell molding, Feb. p. 81
Penetrating fluid inspection, Oct. p. 107
Permanent mold casting, aluminum*, Oct. p. 81
Pin measurements of gears, Jan. p. 118
Pinion gear production, automated*, Oct. p. 116
Planning, see: Management Organization
Planning presswork processes, Jan. p. 95
Plastic cable*, Aug. p. 105
Plastic dies, shorten lead time, Sept. p. 141
Plastic-faced dies, Nov. p. 87
Plastic moldings*, Jan. p. 196
Plastic production, cast molds for, Nov. p. 105
Plastic tooling models*, Mar. p. 239
Plastic tools, June p. 117
Plastics
polyester*, Feb. p. 202
production of parts with matched metal dies, July p. 109
properties and uses of vinyl*, June p. 202
Plate, surface calibration, Oct. p. 85
Plating equipment, automatic*, Jan. p. 94
Pneumatic screwdriver*, Nov. p. 99
Pollution control*, Mar. p. 248
Portable tooling, Dec. p. 91
Power, nuclear pilot plant*, Oct. p. 208
Power and forces in metal cutting, Sept. p. 143
Power nail pulling, Sept. p. 160
Power shears, roller type*, Sept. p. 147
Precision boring*, June p. 100
Precision centers for grinding*, June p. 76
Precision drilling small holes, Feb. p. 95
Precision measuring and gaging*, Nov. p. 207
Press brake contours aluminum plate, Apr. p. 73
Press brake forming, Apr. p. 73
Press brake operation, controlled stroke*, Oct p. 99
Press forming holder*, Oct. p. 84
Press operation
mechanized, Mar. p. 85; July p. 113
small precision parts, Mar. p. 79
trimming forgings*, June p. 102
Press straightening*, Aug. p. 108
Presses
hydraulic, Sept. p. 133
mechanical, Sept. p. 127
Presswork, analysis of, Jan. p. 95
Pressworking theory*, June p. 205
Preventive maintenance*, June p. 198
Principles of grinding, Oct. p. 113
Process planning for presswork, Jan. p. 95
Processes, machine tool
boring, Sept. p. 108
broaching, Sept. p . 94
circular sawing, Sept. p. 114
drilling, Sept. p. 111
gear cutting, Sept. p. 123
grinding and lapping, Sept. p. 117
milling, Sept. p. 86
planing, Sept. p. 99
reaming, Sept. p. 111
tapping, Sept. p. 111
turning, Sept. p. 104
Processing improvement*, Nov. p. 81
Product design, for production*, Nov. p. 209
Production
atomic equipment*, Oct. p. 110
military vehicles*, Mar. p. 253
savings through machine development pro-

*Brief article less than 1 page.

gram, Dec. p. 75
Production design*, Nov. p. 209
Production planning*, Jan. p. 196
see also Process Planning
Production planning, mathematical methods*, Mar. p. 235
Production tolerances, June p. 115
Production turning, speeds and feeds, Feb. p. 119
Production washing machine*, Apr. p. 78
Production welding*, Dec. p. 202
Profile milling, tooling for*, July p. 102
Programming, production engineering problems*, Apr. p. 215
Progressive die, riveting*, July p. 73
Progressive die mechanizes press operation, July p. 113
Projection welding
for automatic assembly, May p. 109
multiple operation*, Nov. p. 101
semiautomatic, Sept. p. 158
Proportioning system, mold sand*, July p. 88
Punch and die for seal assembly*, June p. 77

—Q—

Quality control
automatic on Fay lathe, Aug. p. 73
automatic screw machine*, Mar. p. 243
determining assembly tolerances, Feb. p. 105
management use of*, Apr. p. 222
methods of introducing, Nov. p. 102
mold sand*, July p. 88
spot welding*, July p. 198
stampings*, Mar. p. 257
Quenching heat treated aluminum, June p. 108

—R—

Radiation measurement*, Apr. p. 204
Radio intereference in machine tools, reducing*, July p. 196
Radiometric methods for testing tool life, Apr. p. 79
Rake, negative back avoids tool failures, Jan. p. 83
Rake angles*, Feb. p. 191
Recessing tool*, Aug. p. 77
Repairing bored holes*, Apr. p. 77
Repairing dies*, Sept. p. 138
Repairing dies and tools, low heat joining, May p. 85
Report by Diamond Salvage & Reclamation Panel
Minerals and Metals Advisory Board Nat'l Research Council, March p. 247
Reporting, technical*, Nov. p. 204
Research, tool engineering
chemical metal cutting*, Nov. p. 90
drilling, Mar. p. 99
machining, May p. 105
metal-cutting*, Oct. p. 192
titanium*, Aug. p. 180
Residual stresses in machine surfaces, control of*, Oct. p. 194
Resistance welding, fabricate wire mesh*, Oct. p. 98
Riveting
automatic in aircraft, May p. 91
safety die for*, Sept. p. 138
Riveting die, progressive*, July p. 73
Roll forming toothed parts, Apr. p. 110
Russian machine tools*, Dec. p. 186

—S—

Safety
controls for cycling press, Feb. p. 103
in automation*, May p. 211
industrial health control*, Dec. p. 203
of presses*, Apr. p. 216
see also Testing
Salvage, carbide mandrels*, Feb. p. 84
Sawing, multiple milling type*, Nov. p. 81
Scissors-type gage*, Jan. p. 75
Screwdriver, power driven*, Aug. p. 97
Screwdriving, automatic feeder for*, Sept. p. 146
Selection of grinding wheels, Feb. p. 91
Setup indicator, bar stock*, Aug. p. 80
Shaper, reducing deflection with stiffer ram*, Oct. p. 100
Sheet metal forming, see Die Design and Dies
Shell molding
equipment, Apr. p. 103
process and possibilities, Feb. p. 73
Silver alloy brazing wire, determining amount, July, p. 119
Slitting operation
aluminum castings*, Jan. p. 106
gang for instrument transformers*, July p. 104
Small lot press production, Mar. p. 79
Small-lot welding, arc type, June p. 92
Solution treating*, Aug. p. 108
Spacer bushing for uniform centers*, May p. 78
Special cutting tools*, Aug. p. 79
Special machine
automatic production of relay fingers*, Sept. p. 157
drilling and tapping*, Oct. p. 98
Special socket head screws*, Aug. p. 78
Special T-nuts for fixtures*, Mar. p. 76
Special tooling, undercuts*, May p. 80
Specifications, materials, May p. 201
Speeds and feeds for milling, Oct. p. 97
Speeds and feeds for stainless, Sept. p. 163
Spherical gages*, Apr. p. 77
Spindles, hollow, used for coolant*, Jan. p. 91
Spinning, machine type*, July p. 102
Spiroid gears, newly developed*, Oct. p. 205
Splines and gears, checking measurement, July p. 93
Spot welding, quality control of*, July p. 198
Spraying equipment, metal finishing, Aug. p. 111
Spring, special tension for jigs and fixtures*, Nov. p. 81
Stainless steel, speeds and feeds for, Sept. p. 163
Stainless tubing straightener*, July p. 103
Stamping, see also: Dies Press Operation Process Planning
Stamping, quality control of*, Mar. p. 257
Standards, company for carbide, July p. 78
Standardization, carbide tools, June p. 83
Standardization, gaging, Aug. p. 101
Standardization of numbers*, July p. 180
Statistical inspection*, May p. 196
Statistical methods*, Apr. p. 205
Statistical quality control, see Quality Control
Steels, die, June p. 97
Steels, tool, water hardening type, Feb. p. 87
Steels, tooling, application of, May p. 71
Stop for thin stock*, Dec. p. 80
Stop for progressive feed*, July p. 74
Straddle broaching*, July p. 92
Straightener, stainless steel tubing*, July p. 103
Straightening extrusions, Jan. p. 73
Straightening operation, tubing, hot rolled seamless, June p. 101
Stresses, control of residual in machine surfaces*, Oct. p. 194
Submerged arc welding*, Nov. p. 101
Superfinishing in Europe*, June p. 189
Surface finish and design*, Jan. p. 173
Surface finish specifications*, Apr. p. 212
Surface measurements*, Oct. p. 193
Surface plate calibration, Oct. p. 85
Surface plates, comparison of, Aug. p. 99
Swaging, tubing, Sept. p. 151
Switchboard for blending viscous liquids*, Feb. p. 101

—T—

Tailstock alignment tool*, Jan. p. 77
Tandem drill, Dec. p. 81
Tape controlled machining, Oct. p. 117
Tape controlled milling*, May p. 210
Taper shank tools, locking*, Feb. p. 85
Tapered pin seats, drilling for, June p. 119
Tapping
multi-unit machine*, May p. 88
multiple setup for*, Feb. p. 108
Tapping Acme threads, Mar. p. 81
Technical information, coding and processing, Apr. p. 211
Technical reporting*, Nov. p. 204
Tempering chart for tool steels, Nov. p. 125
Tension spring for jigs and fixtures*, Nov. p. 81
Testing
engines automatically, Nov. p. 117
tool life, radiometric methods, Apr. p. 79
ultrasonic small-sized tubing*, June p. 206
Thread rolling machine*, June p. 90
Threading, special milling cutter*, Sept. p. 150
Time study, work sampling, Nov. p. 115
Titanium
beading*, May p. 77
fabrication*, Mar. p. 241; May p. 207
fusion welding of*, July p. 198
grinding*, Jan. p. 194
low temperature brazing of*, Aug. p. 86
machining, Jan. p. 78
production of*, June p. 195
research in*, Aug. p. 180
Tolerance charts, how to adjust, Oct. p. 75
Tolerances
assembly determined statistically, Feb. p. 105
for gears*, June p. 187
true allowances for, June p. 115
Tool angle standards*, Feb. p. 191
Tool and crib cost cut, Cadillac Motor, Oct. p. 101
Tool design, ceramic single point tool, June p. 73
Tool engineering, education, July p. 69
Tool engineering opportunities, Mar. p. 71
Tool forces, Jan. p. 83
Tool life, Apr. p. 79; Aug. p. 82
Tool life increasing*, Oct. p. 207
Tool life and wear land*, July p. 179
Tool steels
aluminum, stainless, copper, etc. alloys*, Feb. p. 120
application of, May p. 71
tempering chart for, Nov. p. 125
water hardening, Feb. p. 87
Toolholder
for boring*, Nov. p. 80
for undercuts*, May p. 80
Tooling
controls*, Jan. p. 198
cutoff*, Aug. p. 79
door locks, Mar. p. 86
for gear production, July p. 99
for grooving operation*, Oct. p. 82
for plastic parts, Nov. p. 105
magnesium applications, Apr. p. 113
matched metal dies for fiberglass, July 109
multiple for automatic turret lathe*, N p. 100
multiple grinding setup*, Sept. p. 140
optical, see Optical tooling
press assembly operations*, June p. 7
simplified quick-change carbide*, Nov 98
small-lot arc welding, Aug. p. 89
using hollow stock, Nov. p. 114
Tools
Acme thread, Mar p. 81
carbide brazing of, Feb. p. 115
carbide for titanium, Jan. p. 80
cemented oxide, Dec. p. 121
ceramic, Mar. p. 95; June p. 71
cutting, see also Cutting Tools
development of diamond*, July p. 180
effect of dull*, Sept. p. 270
increasing life of*, Oct. p. 207
plastic, application of, June p. 117
punch failure, July p. 107
recessing type*, Aug. p. 77
special cutting*, Aug. p. 79
see also Machine Tools
Tools and dies, repairing with low heat joining, May p. 85
Torch cutting*, Dec. p. 112
Torquing threaded fasteners*, Aug. p. 97
Training engineers
educational requirements, July p. 69
large organization, May p. 101
plan for executives*, Dec. p. 200
small organization, May p. 99
Westinghouse plan upgrades technical personnel, July p. 191
Transfer machine*, May p. 90
Transfer machine of standard elements, July p. 89
Transfer press operation*, Apr. p. 102
Trim die marker*, Jan. p. 75
Trunnion fixture*, Mar. p. 91
Tube flattening*, Jan. p. 76
Tube production improved, welding process*, Nov. p. 109
Tube straightening*, June p. 101
Tube swaging, Sept. p. 151
Turning large crankshafts*, July p. 103
Turning, tracer controlled lathe*, July p. 106
Turret lathe, automatic, see Lathe
TV tube production*, Apr. p. 100

—U—

Ultrasonic cleaning*, Aug. p. 166
Ultrasonic testing, small-size tubing*, June p. 206
Unionization of engineering*, May p. 206
Unions for engineers, June p. 103
Unit term indexing, July p. 116
Universal self-centering drill jig*, Nov. p. 79
Upgrading engineers, July p. 191
Use of engineers, July p. 191

—V—

Vacuum faceplate*, Feb. p. 100
Vacuum furnace, carbide*, Sept. p. 159
Variable speed drive, analysis*, Dec. p. 185
V-groove turning, setup for*, May p. 78
Vibration of end mills*, July p. 178
Vibrations, high-frequency, in grinding*, Dec p. 198
Vibrations, in milling operations, Nov. p. 82
Vise, large capacity*, July p. 75

—W—

Washing parts in production*, Apr. p. 78
Waste treatment, cutting costs*, Mar. p. 248
Water hardening tool steels, Feb. p. 87
Wear land and tool life*, July p. 179
Welding
arc installation design, Feb. p. 112
arc, for small lots, June p. 92
arc, small-lot tooling, Aug. p. 89
Congress, European*, Dec. p. 186
cross-wire resistance, Dec. p. 111
flash high-strength alloy steels, Feb. p. 204
fusion type of titanium*, July p. 198
hidden-arc, Nov. p. 95
high-speed machine for wire mesh, Oct. p. 98
improved process for tube production* Nov. p. 109
jigs*, Feb. p. 114
multiple projection*, Nov. p. 101
production report of*, Dec. p. 202
projection, May p. 109; Sept. p. 158*
small production, equipment and processes, July p. 83
submerged arc*, Nov. p. 101; Mar. p. 250
techniques*, Sept. p. 272
Welding dies, Mar. p. 92
Wet blasting*, Feb. p. 190
Wheels, grinding, see Grinding Wheels
Work holding
multiple clamping jaws*, Feb. p. 84

*Brief article less than 1 page.

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D

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E

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G

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Gisholt Machine Co.
Glenzer, J. C., Co.
Gorton, George, Machine Co.
Gould & Eberhardt, Inc.
Govro-Nelson Co.
Greaves Machine Tool Division,
J. A. Fay & Egan Co.
Greenfield Tap & Die Corp.,
Ampco Twist Drill Division
Geometric Tool Company Division
Greenleaf Corp.,
Newcomer Products, Inc.
Greenlee Bros. & Co.
*Griswold, F. T., Mfg. Co.
Gulf Oil Co.

H

*Hammond Machinery Builders, Inc.
*Handy & Harman
♦Hanna Engineering Works
Hannifin Corp.
*Hardinge Brothers, Inc.
♦Hartford Special Machinery Co., The
Hassall, John, Inc.
Hause Engineering
Haynes Stellite Co.,
A Division of Union Carbide & Carbon Corp.
Heald Machine Co., Subsidiary
The Cincinnati Milling Machine Co.
Heinrich Tools, Inc.
*Heller Machine Co.
Hendey Machine Division,
Barber-Colman Co.
Hill Acme Co., The
Hill Machine Co.
Hirschmann, Carl, Co., Inc.
*Hi-Shear Rivet Tool Co., The
Hoggson & Pettis Mfg. Co.
♦*Horton Chuck
Houghton Laboratories, Inc.
Howe & Fant, Inc.
Huron Machine Products
Hutchinson, Wm. T., Co.
Hydraulic Power Division,
Hydraulic Press Mfg. Co.
*Hydro-Borer Co.
Hydro-Line Mfg. Co
Hyprez Division,
Engis Equipment Co.
Hy-Pro Tool Co.

I

*Ideal Industries, Inc.
*Illinois Tool Works
Industrial Diamond Association of America
Industrial Gages, Inc.
Ingersoll Milling Machine Co., The
Ingersoll-Rand, Inc.

J

J & S Tool Co., Inc.
♦*Jacobs Mfg. Co.
Jahn, B., Mfg. Co., The
Jansson Gage Co.
*Jarvis Corp.
Jergens Division,
Donley Products, Inc.
Jessop Steel Co.
Johnson, Carlyle, Machine Co.
Johnson, S. C. & Sons, Inc.
Jones & Lamson Machine Co.

K

Kaufman Mfg. Co.
*Kaydon Engineering Corp., The
Frauenthal Division
*Kearney & Trecker Corp.
*Kearney & Trecker Corp.,
Walker-Turner Division
♦Keller Tool Division,
Gardner-Denver Corp.
Kempsmith Machine Co.
*Kenco Mfg. Co.
Kennametal, Inc.
♦Kingsbury Machine Tool Co.
Kling Bros. Engineering Works
Knight, W. B., Machinery Co.
Krueger-Barnes Corp.
Kurt Orban Co., Inc.

L

*Lamina Dies & Tools, Inc.
*Landis Machine Co.
Lapeer Mfg. Co.
Lapointe Machine Tool Co., The
*Latrobe Steel Co.
*Lavallee & Ide, Inc.
Lawley Granite Surface Plate Co.
Lee, K. O., Co.
*Lees-Bradner Co.
♦Lehigh Foundries, Inc.
Lepel High Frequency Laboratories
*Levin, Louis & Son, Inc.
Liberty Tool & Die Corp.
♦Lincoln Electric Co.
Lincoln Gage Co.
Lincoln Park Industries, Inc.
*Lindberg Engineering Co.
*Lindberg Engineering Co.,
High Frequency Division
Linde Air Products Co.,
A Division of Union Carbide & Carbon Corp.
Lion Mfg. Co.
Lipe-Rollway, Inc.
Littell, F. J., Machine Co.
Lobdell United Division,
United Engineering and Foundry Co.
*Lodding, Inc.
Logan Engineering Co.
*Lovejoy Tool Co.
Lucas Machine Division,
New Britain Machine Co., The
*Lufkin Rule Co., The

M

Macklin Co.
Madison Industries, Inc.
♦Madison Mfg. Co.
Magna Driver Corp.
Mallory, P. R., & Co., Inc.
Manhattan Rubber Division,
Raybestos-Manhattan, Inc.
Marathon Electric Mfg. Corp.
Master Mfg. Co.
Matthews, Jas. H., & Co.
Maxwell Co., The
Mayline Co.
*M-B Products
*M.B.I. Export & Import, Ltd.
*McDonough Mfg. Co.
McKay Machine Co., The
Meehanite Metal Corp.
*Melin Tool Co., Inc.
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*Merz Engineering, Inc.
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Metal Lubricants Co.
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♦Meyers, W. F., Co.
♦Michigan Drill Head Co.
Michigan Tool Co.
Micromatic Hone Corp.
Mikay Co.
*Milford Rivet & Machine Co., The
*Miller Fluid Power Co.
Milne, A., & Co.
Modern Tool Works Division,
Consolidated Machine Tool Corp.
*Modernair Corp.
Mohawk Tools, Inc.
Moline Tool Co.
Monarch Machine Tool Co.
Moore Special Tool Co.
Morey Machinery Co., Inc.
Morris Machine Tool Co.
Morrison Engineering Co.
Morse, H. E., Co.
Morse Twist Drill & Machine Co.
*Morton Machine Works
Morton Mfg. Co.
*Motch & Merryweather Machinery Co., The

N

National Acme Co., The
National Automatic Tool Co., Inc.
National Broach & Machine Co.
National Machine Tool Builders' Assoc.
National Twist Drill & Tool Co.
*Nelco Tool Co., Inc.
New Britain Machine Co., The
Newcomer Products, Inc.,
Greenleaf Corp.
New England Tap Co.
*New Standard Division,
U. S. Expansion Bolt Co.
New York Air Brake Co., The
Niagara Machine & Tool Works
Nice Ball Bearing Co.
Nilson, A. H., Machine Co., The
Noble & Westbrook Mfg. Co.
Nobur Mfg. Co.
Norgren, C. A., Co.
Norton Co.,
Abrasive Grain Division
Abrasive Grinding Wheel Division
Machine Division

O

*Oakite Products, Inc.
Ohio Crankshaft Co., The
Ohio Knife Co., The
Ohio Seamless Tube Division,
Copperweld Mfg. Co.
O. K. Tool Co., Inc., The
O'Neil-Irwin Mfg. Co.
Orban, Kurt, Co., Inc.
♦*Ortman-Miller Machine Co.
Osborn Mfg. Co., The
Ottemiller, Wm. H., Co.

P

Palley Supply Co.
Parker-Kalon Corp.
Parker-Majestic, Inc.
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Pennsylvania Salt Mfg. Co.
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Pines Engineering Co., Inc.
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*Portage Double-Quick Tool Co.
Porter, H. K., Co.,
Vulcan Crucible Co., Division
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*Precise Products Corp.
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*Procunier Safety Chuck Co.
Production Aids
Production Engineering Show,
Clapp & Poliak, Inc.
Production Specialties, Inc.
Producto Machine Co., The
Putnam Tool Co.

Q

Quality Tool Works

R

R and L Tools, Inc.
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R-B Tool Co., Inc.
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*Red Seal Metals Co.
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*Reliant Industries, Inc.
Ren-Ite Plastics, Inc.
*Rezolin, Inc.
Richard Brothers Punch Division,
Allied Products Corp.
*Richards, J. A., Co.
*Rimat Tool Co.
Ring Punch & Die Co.
Rivett Lathe & Grinder Co., Inc.
Robbins, Omer E., Co.
Robinson Aviation, Inc.
*Rockwell Mfg. Co.,
Delta Power Tool Division
Rotor Tool Co., The
Russell, Holbrook & Henderson, Inc.
Ruthman Machinery Co., The

S

*Sales Service Machine Tool Co.
Scherr, Geo. Co., Inc.
Scherr, Geo., Optical Tools, Inc.,
Division of Geo. Scherr Co., Inc.
Schmidt, Geo. T., Co.
Schrader's, A., Son,
Division of Scoville Mfg. Co., Inc.
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Seaboard Steel Company of America
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Sentry Co.
*Service Machine Co.
Severance Tool Industries, Inc.
*Sheffield Corp., The
Sheldon Machine Co.
Shell Oil Co.
Sibley Machine & Foundry Corp.
Sidney Machine Tool Co.
*Simonds Abrasive Co.
*Simonds Saw & Steel Co.
*Skinner Chuck Co., The
Smit, Anton, & Co., Inc.
Snow Mfg. Co.
Snyder Tool & Engineering Co.
Sonnet Tool & Mfg. Co.
South Bend Lathe Works
*S-P Mfg. Corp.
*Standard Gage Co., Inc.
*Standards Parts Co.
*Standard Pressed Steel Co.
Standard Shop Equipment Co.
Standard Tool Co.
Staples Tool Co.
*Starrett, L. S., Co., The
*Steel City Testing Machines, Inc.
Steel Products Engineering Co.,
Brehm Die Division
Stone Machinery Co., Inc.
Stuart, D. A., Oil Co., Ltd.
Sturdy Broaching Co.
Sturtevant, P. A., Co.
Sun Oil Co.
Sundstrand Machine Tool Co.
Sundstrand Machine Tool Co.,
American Broach & Machine Co.
Division
*Super Tool Co.
Superior Steel Products Corp.
Sutton Tool Co.
*Syntron Co.

T

Taft-Peirce Mfg. Co., The
Tapmatic Corp.
*Taylor Dynamometer and Machine Co.
Thiokol Chemical Corp.
Thompson Grinder Co.
Threadwell Tap & Die Co.
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Timken Roller Bearing Co.
Titan Tool Co.
♦*Tomkins-Johnson Co.
Torrington Co., The
Tracer Control Corp.
*True-Trace Sales Corp.
Twentieth Century Mfg. Co.

U

Uddeholm Company of America, Inc.
Union Carbide & Carbon Corp.,
Bakelite Company, A Division
Haynes Stellite Company, A Division
Linde Air Products Company, A
Division
Union Twist Drill Co.,
Butterfield Division
S. W. Card Division
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Lobdell United Division
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U. S. Drill Head Co.
*U. S. Expansion Bolt Co.
New Standard Division
U. S. Industries, Inc.
Axelson Mfg. Co., Division
Clearing Machine Corp., Division
*United States Rubber Co.
*U. S. Tool Co., The
Universal Engineering Co.

V

*V & O Press Co., The
Division of Emhart Mfg. Co.
Valenite Metals Corp.
Valvair Corp.
*Van Keuren Co.
Vanadium-Alloys Steel Co.
*Vascoloy-Ramet Mfg. Corp.
Verson Allsteel Press Co.
*Vlier Engineering Co.
Von Industries, Inc.
Vulcan Crucible Co., Division,
H. K. Porter Co.
Vulcan Tool Co.

W

*Wade Tool Co.
Wadell Equipment Co.
Wahlstrom/Float-Lock Division,
American Machine & Foundry Co.
♦*Waldes Kohinoor, Inc.
*Wales-Strippit Corp.
Walker, O. S., Co., Inc.
*Walker-Turner Division,
Kearney & Trecker Corp.
Wallington Sales Co.
Ward Machinery Co.
Warwick Twist Drill Co.
Waukesha Tool Co.
*Webber Gage Co.
♦Wellman Engineering Co.,
Anker-Holth Division,
A McDowell Enterprise
Wesson Co.
West Point Mfg. Co.
Wheel Trueing Tool Co.
*Whistler, S. B., & Sons, Inc.
White & Bagley, Inc.
White-Rogers Electric Co.
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Wiedemann Machine Co.
*Willey's Carbide Tool Co.
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Inc.
♦Wilson Mechanical Instrument
Division,
American Chain & Cable Co.
Wilton Tool Co.
♦Winter Brothers, Division of
National Twist Drill & Tool Co.
Wood & Spencer Co.
Woodson Tool Co.
Woodworth, N. A., Co.

Y

Yoder Co., The

Z

Zagar Tool, Inc.
Ziegler, W. M., Tool Co.

Index of THE TOOL ENGINEER Advertisers

December 1955 Issue

The Index to Advertisers is published as a reader service. Although every precaution is taken to assure correct listing, no allowance will be made for error or omission.

*Exhibitor in ASTE Western Industrial Exposition

♦User of ASTE Data Sheets

A

*Ace Drill Bushing Co., Inc. 226
*Adamas Carbide Corp. 163
♦Air-Mite 242
Alina Corp. 252
*Allegheny Ludlum Steel Corp. 236
Allen Mfg. Co. 237
Allied Products Corp.,
Richard Brothers Punch Division 22
♦Allison Co., The,
Division of American Chain & Cable Co. 177
American Brass Co., The 23
American Broach & Machine Co.,
Division of Sundstrand Machine Tool Co. 190
♦American Chain & Cable Co.,
Allison Co., A Division 177
Campbell Machine Division 56
♦*American Drill Bushing Co. 13
American Machine & Foundry Co.,
Wahlstrom/Float-Lock Division 216
American Positive Grip Vise Corp. 238
*American Society of Tool Engineers 260, 268
American Tool Works Co., The 12
*Ames, B. C., Co. 183
Anderson, F. E., Oil Co. 167
Armstrong-Blum Mfg. Co. 178
Arter Grinding Machine Co. 156
Atrax Co., The 214
Axelson Mfg. Co.,
Division of U. S. Industries, Inc. 63, 255

B

♦Baker Brothers, Inc. 213
*Balas Collet Mfg. Co. 280
Barber-Colman Co.,
Hendey Machine Division 68-69
Barksdale Valves 194
*Bath, John, Co., Inc. 263
Bay State Tap & Die Co. 216
Bethlehem Steel Co. 215
Blanchard Machine Co., The 48
Bodine Corp., The 253
Boston Gear Works 42
*Boyar-Schultz Corp. 158
♦*Bristol Co., The 222
*Burg Tool Mfg. Co. 258

C

♦Campbell Machine Division,
American Chain & Cable Co. 53
*Carboloy,
Department of General Electric Co. 33, 205-212
Carlton Machine Tool Co., The 188
Carpenter Steel Co., The 254
Chicago Pneumatic Tool Co. 259
*Chicago Rivet & Machine Co. 242
Ciba Co., Inc. 195
Cincinnati Milling Machine Co.,
Heald Machine Co., A Subsidiary Inside Front Cover
Cincinnati Shaper Co. 34-35
Cleveland Twist Drill Co. 245
Colonial Broach & Machine Co. 15
Columbia Tool Steel Co. 164
Comtor Co. 250
Cone Automatic Machine Co. 257
Consolidated Machine Tool Corp. 71
Cross Co., The 74
Crucible Steel Company of America 49

D

*Danly Machine Specialties, Inc. 249
*Davis, A. G., Gage & Eng. Co. 159
Dazor Mfg. Corp. 238
*Deakin, J. Arthur, & Son 250, 252
*Delta Power Tool Division,
Rockwell Mfg. Co. 221
Detroit Broach Co. 206
Detroit Die Set Corp. 223
Detterbeck Geo. L., Co. 216
DeVlieg Machine Co. 53
Disston, Henry, and Sons, Inc. 70
*DoALL Co. 57-58
*Dow Chemical Co., The 10
Dykem Co., The 250

E

Eastman Kodak Co.,
Graphic Reproduction Division 179
Special Products Sales Division 267
Elgin National Watch Co. 258
*Elox Corporation of Michigan 61
*Engelberg-Huller Co., Inc., The 176
*Engis Equipment Co. 173
Ettco Tool Co., Inc. 153
Ex-Cell-O Corp. Inside Back Cover

F

*Federal Products Corp. 227
Fellows Gear Shaper Co. 251
Foote-Burt Co., The 64
*Furane Plastics, Inc. 242

G

♦*Galland-Henning Mfg. Co. 232
Gammons-Hoaglund Co. 234
♦Gardner-Denver,
Keller Tool Division 244
*General Electric Co.,
Carboloy, Department of 33, 205-212
Gisholt Machine Co. 17-20
Glenzer, J. C., Co. 234

H

♦Hanna Engineering Works 231
Hannifin Corp. 248
*Hardinge Brothers, Inc. 5
Haynes Stellite Co.,
A Division of Union Carbide & Carbon Corp. 246
Heald Machine Co., Subsidiary
The Cincinnati Milling Machine Co. Inside Front Cover
*Heller Machine Co. 256
Hendey Machine Division,
Barber-Colman Co. 68-69
Hill Machine Co. 258
Hoggson & Pettis Mfg. Co. 252
Houghton Laboratories, Inc. 187
Howe & Fant, Inc. 201
Hydraulic Power Division,
Hydraulic Press Mfg. Co. 161

I

*Illinois Tool Works 25
Ingersoll-Rand, Inc. 265

J

♦*Jacobs Mfg. Co. 186
Jansson Gage Co. 232

K

Kearney & Trecker Corp. 243
*Kearney & Trecker Corp.,
Walker-Turner Division 166
♦Keller Tool Division,
Gardner-Denver Corp. 244
*Kenco Mfg. Co. 252
Kennametal, Inc. 196
♦Kingsbury Machine Tool Co. 59
Kurt Orban Co., Inc. 232

L

Lamina Dies & Tools, Inc. ... 165
Landis Machine Co. ... 8
Lapointe Machine Tool Co., The ... 11
Lavallee & Ide, Inc. ... 173
Lee, K. O., Co. ... 252
Lindberg Engineering Co.,
High Frequency Division ... 47
Lion Mfg. Co. ... 234
Lucas Machine Division,
The New Britain Machine Co. ... 229

M

♦Madison Industries, Inc. ... 16
Mallory, P. R., & Co., Inc. ... 218
Manhattan Rubber Division,
Raybestos-Manhattan, Inc. ... 46
Matthews, Jas. H., & Co. ... 222
Mayline Co. ... 232
Melin Tool Co., Inc. ... 203
Metal Carbides Corp. ... 222
*Miller Fluid Power Co. ... 32
Milne, A., & Co. ... 41
Moline Tool Co. ... 170
Monarch Machine Tool Co. ... 225
Morse Twist Drill & Machine Co. ... 30-31
*Motch & Merryweather Machine Co., The ... 21

N

National Acme Co., The ... Back Cover
National Automatic Tool Co., Inc. ... 241
National Broach & Machine Co. ... 51
♦National Twist Drill & Tool Co. ... 6-7
New Britain Machine Co., The ... 229
New England Tap Co. ... 169
Nilson, A. H., Machine Co., The ... 182
Norton Co.,
Abrasive Grinding Wheel Division ... 26
Machine Division ... 44-45

O

*Oakite Products, Inc. ... 65
Ohio Crankshaft Co., The ... 72
O'Neil-Irwin Mfg. Co. ... 184
Orban, Kurt, Co., Inc. ... 232
♦Ortman-Miller Machine Co. ... 160
Osborn Mfg. Co., The ... 240
Ottemiller, Wm. H., Co. ... 234

P

Parker-Majestic, Inc. ... 180
Parker Stamp Works ... 174
Pioneer Tool Engineering, Inc. ... 52
*Pipe Machinery Co. ... 239
*Portage Double-Quick Tool Co. ... 162
Porter, H. K., Co.,
Vulcan Crucible Co., Division ... 157
Pratt & Whitney Co., Inc. ... 29, 192-193, 261
*Precise Products Corp. ... 164

R

R and L Tools, Inc. ... 67
Raybestos-Manhattan, Inc.,
Manhattan Rubber Division ... 46
Rehnberg-Jacobson Co. ... 235
*Reliant Industries, Inc. ... 60
Richard Brothers Punch Division,
Allied Products Corp. ... 22
*Richards, J. A., Co. ... 228
Ring Punch & Die Co. ... 152
Robbins, Omer E., Co. ... 168
*Rockwell Mfg. Co.,
Delta Power Tool Division ... 221
Rotor Tool Co., The ... 191
Russell, Holbrook & Henderson, Inc. ... 43

S

Scherr, Geo., Co., Inc. ... 194
Schmidt, Geo. T., Co. ... 238
Schrader's, A., Son,
Division of Scovill Mfg. Co., Inc. ... 217
♦*Scully-Jones & Co. ... 54-55
Sentry Co. ... 175
*Service Machine Co. ... 228
Sheldon Machine Co. ... 200
*Skinner Chuck Co., The ... 185
Smit, Anton, & Co., Inc. ... 262
Snow Mfg. Co. ... 219
Snyder Tool & Engineering Co. ... 37-40
*Standard Gage Co., Inc. ... 4
*Standard Parts Co. ... 160
Standard Tool Co. ... 233
*Starrett, L. S., Co., The ... 27
Stuart, D. A., Oil Co., Ltd. ... 24
Sturdy Broaching Co. ... 228
Sun Oil Co. ... 2
Sundstrand Machine Tool Co.,
American Broach & Machine Co., Division ... 190
Sutton Tool Co. ... 150

T

Taft-Peirce Mfg. Co., The ... 14, 220, 247
♦*Tomkins-Johnson Co. ... 204
Torrington Co., The ... 62
Tracer Control Corp. ... 198
*True-Trace Sales Corp. ... 262

U

Union Carbide & Carbon Corp.,
Haynes Stellite Company, A Division ... 246
U. S. Drill Head Co. ... 50
U. S. Industries, Inc.
Axelson Mfg. Co., Division ... 63, 255
*United States Rubber Co. ... 230

V

*Vascoloy-Ramet Mfg. Corp. ... 28
Verson Allsteel Press Co. ... 66
Vulcan Crucible Co., Division,
H. K. Porter Co. ... 157
Vulcan Tool Co. ... 250

W

*Wade Tool Co. ... 9
♦Wahlstrom/Float-Lock Division,
American Machine & Foundry Co. ... 216
*Waldes Kohinoor, Inc. ... 199
*Walker-Turner Division,
Kearney & Trecker Corp. ... 166
Wesson Co. ... 154
West Point Mfg. Co. ... 228
White & Bagley, Inc. ... 202
*Willey's Carbide Tool Co. ... 185
♦Winter Brothers, Division
National Twist Drill & Tool Co. ... 6-7
Wood & Spencer Co. ... 36
Woodson Tool Co. ... 262

Z

Zagar Tool, Inc. ... 224
Ziegler, W. M., Tool Co. ... 262

THE TOOL ENGINEER REGIONAL ADVERTISING OFFICES

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Imagine the money you can save, the grief you can avoid by using Balas Collets in all your machines. You don't pay extra for these fine collets and you're sure of long, trouble-free performance. Remember Balas Collets for all your machines are sold on a free replacement or money-back guarantee if they pull off at the thread. Always order Balas.

Illustrated at the left is a 1¼" Balas Collet for an Acme Machine. Note the design and manufacturing quality.

At the right is another brand of collet. See how the threads have been pulled off the body. Imagine the damage that was caused, the time lost in removing the thread from the tube and replacing a new collet.

BALAS also makes:

Pushers and Feed Fingers
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cleveland 14, ohio

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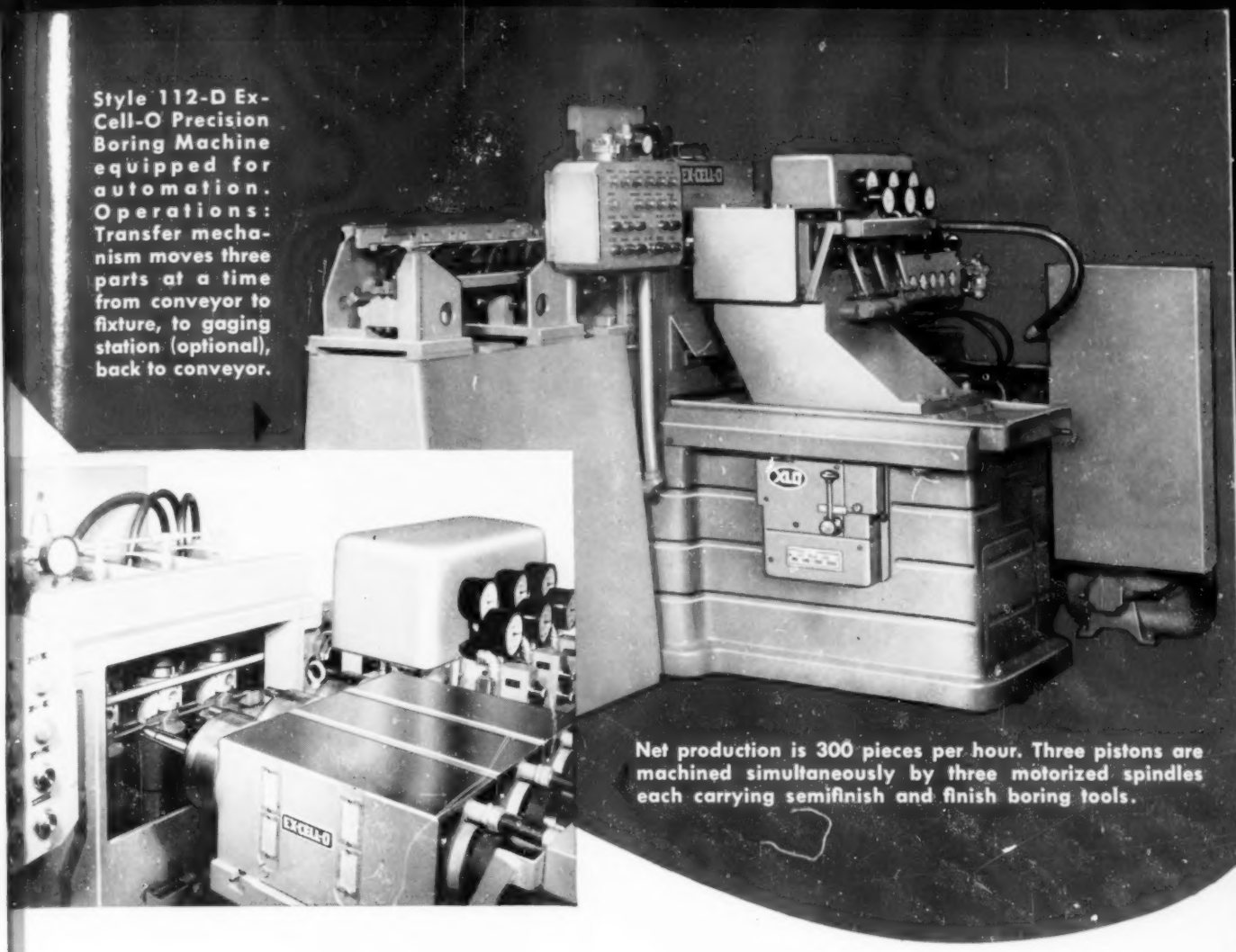

Style 112-D Ex-Cell-O Precision Boring Machine equipped for automation. Operations: Transfer mechanism moves three parts at a time from conveyor to fixture, to gaging station (optional), back to conveyor.

Net production is 300 pieces per hour. Three pistons are machined simultaneously by three motorized spindles each carrying semifinish and finish boring tools.

Standard EX-CELL-O Machine Equipped for AUTOMATION

FAST, ACCURATE PRECISION BORING OF WRIST PIN HOLES

Pistons are brought automatically from the conveyor to boring position, three at a time. Operations are fast and accurate, producing a fine finish.

Automatic Inspection equipment may be incorporated, with lights to indicate size limit warnings and rejections; a rejection stops the machine.

Call your Ex-Cell-O representative or write Ex-Cell-O in Detroit for complete facts on this or similar production savings opportunities through automation.

XLO

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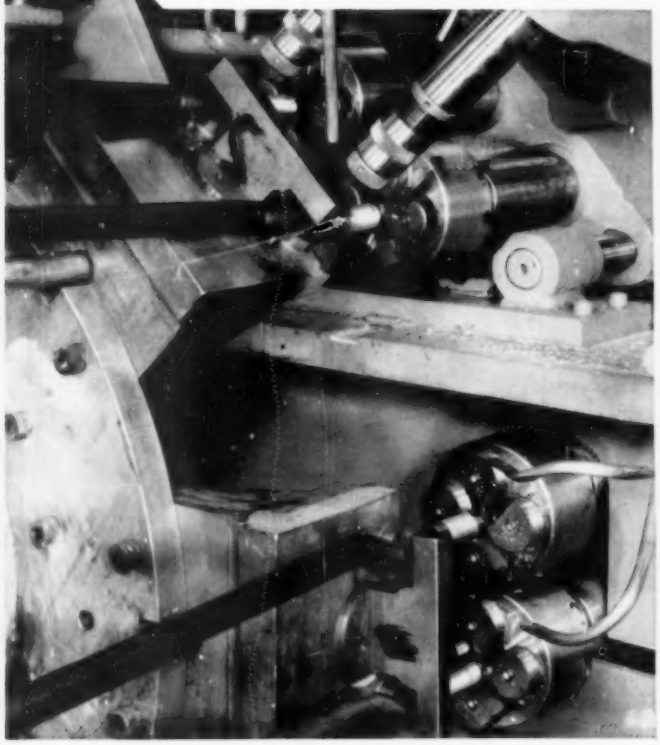
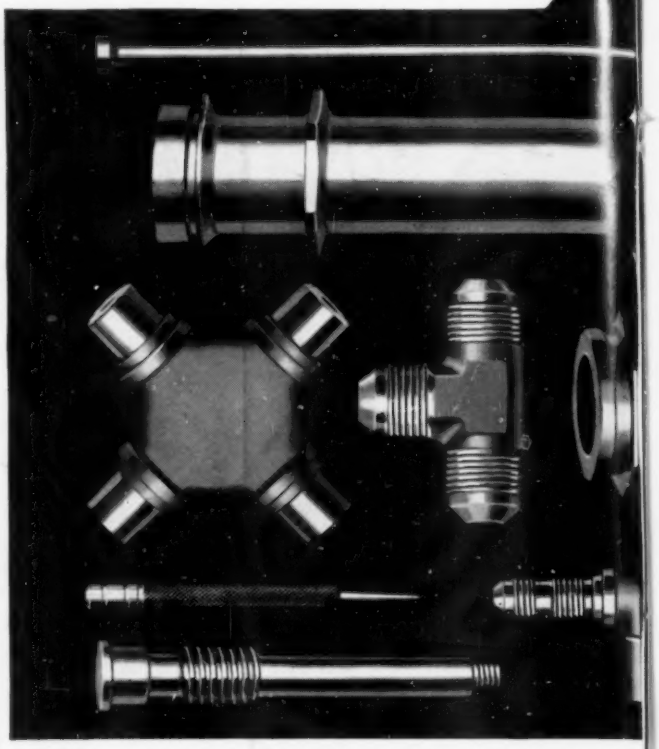
- DAIRY EQUIPMENT

55—46

for hollow milling . . . end forming and turning . . . for knurling, burnishing or threading—on short or long runs



On this Cleveland tapping machine, two Namco Vers-o-tools with circular hollow milling cutters prepare these forged steel rods for threading in the next station where two Vers-o-tools are equipped with circular ground thread chasers.



To do threading and turning jobs like these and thousands of others, better and cheaper, investigate the Vers-o-tool system. Catalog DT-52 describes the method and shows the complete line. Our representative will give you the answers on your jobs.

NAMCO VERS-O-TOOLS save time . . . tooling costs . . . additional grinding operations

Hollow milling, even to a very close micro finish, is three times faster with multi-cutter Vers-o-tool Heads than with single point tools. Knurling and burnishing jobs show similar time savings and accuracies. Threading also costs less per piece because with the Vers-o-tool "system" the guess-work is taken out of chaser grinding.

Further savings, too, in tool investment—chasers, cutters and rolls are interchangeable (size for size) in the same "double duty" Vers-o-tool heads.

24-hour deliveries on most standard stockable chasers and blocks—NC, NF, National taper pipe and Dry Seal.

OUR JOB: to provide the *Right Machine* for **YOUR JOB**

Acme-Gridley 4, 6 and 8 Spindle Automatic Bar and Chucking Machines • Fully Automatic Turret Lathes (Bar and Chuck Type) • Hydraulic Thread Rolling Machines • Automatic Threading Tools • Switches •

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